NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mars Exploration Program

Public Engagement Plan

April, 2002
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MARS PROGRAM: PUBLIC ENGAGEMENT PLAN

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This plan will be reviewed and updated annually to remain consistent with the changes in the Mars Program Plan and the Space Science Enterprise Strategic Plan, as well as to take advantage of new opportunities and alliances that engage the public in the exploration of Mars. The JPL Manager for Mars Public Engagement is responsible for maintenance of this document.

CHANGE LOG

April, 2005

Updated text to reflect new NASA organization (e.g., Δ Office of Space Science to Science Mission Directorate).

Updated Appendices B, G, and H to reflect current information.

Added Appendix I to show alignment with NASA Office of Education Operating Principles (the basis on which E/PO programs are now evaluated); Appendix J to show alignment with NASA Strategic Goals and Objectives; and, Appendix K to show review/evaluation summaries.

Updated each activity to reflect alignment with NASA Strategic Goals and Objectives and NASA Office of Education Operating Principles (the basis on which E/PO programs are now evaluated).

Moved Athena Student Interns from the Robotics Education Partnership (Formal Education Thread T2) to Student Imaging and Analysis (Formal Education Thread T1) given that, in practice, it was more geared to that learning area than Robotics. However, a robotics intern program was retained as a goal in the original section.

April, 2004

Updated Appendix B to reflect new mission timeline.

Updated Appendix H to reflect staff changes.

April, 2003

Updated Appendix B to reflect new mission timeline.

Updated Appendix H to reflect staff changes.

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5.0 Appendices

1.0 EXECUTIVE SUMMARY

Mars exploration is NASA's signature effort in planetary science over the next two decades. It is one of the largest programs in NASA's Science Mission Directorate, and unlike any other program, will provide regular and frequent voyages to the red planet. As a space-faring society, people can regard Mars exploration as one of the most prominent turn-of-the-millennium endeavors to step beyond our home planet and out into the cosmos.

Such a compelling program deserves equally forward-looking initiatives to engage the public in Mars exploration, scientific discovery, and technological achievements. A guiding principle is that we should be as daring, wise, and path-finding in our public engagement efforts as we are in designing ambitious, yet achievable, missions. The benefit of a twenty-year plan is that public engagement can be intimately linked with the long-term goals of the Mars Exploration Program. Public engagement initiatives also have time to bear fruit. Looking out into the future with vision, boldness, and creativity will also provide an environment for encouraging openness and innovation in planning and implementation.

Mars Public Engagement will incorporate the four science goals of the Mars Exploration Program and its guiding theme of "Follow the Water" into its activities to the fullest extent possible. They are:

Goal One: Determine if Life ever arose on Mars

Goal Two: Characterize the Climate of Mars

Goal Three: Characterize the Geology of Mars

Goal Four: Prepare for Human Exploration of Mars

The exciting technology developments and the mission team members who make scientific discoveries possible will also be emphasized in Mars Public Engagement activities.

MARS PUBLIC ENGAGEMENT VISION

Mars Public Engagement has a two-part vision that will guide the implementation of all activities:

- Sharing the Adventure; and,
- Making Mars a Real Place.

Sharing the Adventure means that real opportunities will be created for the public not only to follow along, but also to participate directly and interactively in Mars exploration.

Making Mars a Real Place means providing the public with direct and "virtual" experiences with the red planet in a way that transforms Mars from a series of returned images to something that is as psychologically real as someone's backyard.

LONG-TERM GOALS AND SUPPORTING OBJECTIVES

In order to support the vision—Sharing the Adventure and Making Mars a Real Place, it is important to reach out broadly, but also to provide a sense that the connection is personally meaningful. Abundant opportunities for the public to participate directly in the experience of Mars exploration will assist in that, as will strong connections to schools, museums, civic organizations, homes, and other community centers where people live their lives. To achieve the vision, all Mars Public Engagement activities will be selected and managed with the following goals in mind:

Goal 1: Communicate the story of Mars Exploration in a way that builds on enduring human themes (e.g., the challenges and the triumphs of voyaging into the unknown) and focuses on the discovery of new knowledge through pursuit of the Program's science and technology goals;

Goal 2: Improve and rigorously evaluate our programs to assure our contributions are reaching diverse student populations and equitably enhancing the quality of science, mathematics, and technology education for all Americans;

Goal 3: Provide timely, accurate information that responds to public interest in mission safety (including the use of various power sources, sample returns, and planetary protection at Mars and on Earth);

Goal 4: Create the means for direct public involvement in missions and programs; and,

Goal 5: Ensure the continuous infusion of new ideas in programming.

Objectives supporting these goals include:

Objective 1: Support the development of high-definition visualizations and other immersive experiences in classrooms, museums, and other places of public gathering;

Objective 2: Build strong networks, in cooperation with scientists and engineers and with education, museum, and communications leaders and organizations, that allow new Mars knowledge, images, and visualizations to be experienced by audiences nationwide;

Objective 3: Integrate Mars science with other areas of knowledge (art, music, etc.) that together make an enriched and compelling human experience;

Objective 4: Invest in programs and infrastructures that promote easy access for customers (e.g., one-stop shop for classrooms; dedicated servers and direct down-links for museums);

Objective 5: Encourage "public engagement payloads" (e.g., cameras and other experiential software and hardware) in missions; and,

Objective 6: Provide more real-time (or near-real-time) data and more opportunities for public interactions with Mars experts nationwide.

KEY VALUES

In meeting these objectives, Mars Public Engagement will actively respond to principles laid out in NASA's Office of Space Science Strategic Plan, November 2000 (Appendix C), as well as recommendations found in two principal guiding documents:

- Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs (1995); and,
- Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy (1996).

Especially important are the following five principles. In this plan, they are listed as **values** that cross-cut all objectives, rather than as objectives in and of themselves, because they are critical components of all activities and inseparable from the successful implementation of Mars Public Engagement.

- **Participation by Scientists and Engineers**
  The community of scientists, engineers, and support staff working on the Mars program can make significant and measurable contributions in the planning and implementation of public engagement activities. The mission team members have a special and important role in enhancing scientific and technological literacy throughout the country, as they are role models for the next generation of space explorers.
- **Opportunities for Under-represented Audiences**
  Projections by the U.S. Bureau of the Census show that, by the year 2030, the elementary school-age population of the U.S. will be equally divided between non-Hispanic whites and all other racial and ethnic groups combined. The divide between economic "haves" and "have nots" is also predicted to widen. Educational equity is therefore one of the highest priorities for NASA and for the nation.
- **Understanding What Our Partners and Constituencies Really Need**
  Effective public engagement depends on understanding the interests of our constituencies and responding to them. By understanding the goals of our potential partners and customers and working with them from the beginning, NASA/Mars can identify mutually beneficial projects with high payoffs.

- **Opportunities to Leverage Resources Around Common Goals**
  The idea of partnership begins with drawing upon expertise residing within the Mars community (universities, industry partners, NASA, JPL, other NASA Centers). Only by building on the strengths and areas of synergy of the Mars community will we be able to bring more to the table in forming external alliances. Working with outside partners, particularly those already self-organized in networks, will enable the program to extend its reach even farther.

- **Evaluation**
  To ensure quality, impact, and effectiveness, evaluation will be a central part of all phases of a product or activity, from design to dissemination. Each effort will have specific long-term goals identified, with clear benchmarks for evaluating progress toward those goals.

The Mars Public Engagement Plan's five *Key Values* also correlate with Operating Principles in the 2003 NASA Education Enterprise Strategy, which are used in NASA Office of Education evaluative reviews as performance indicators (see also Appendix I): Participation by scientists and engineers (Content); Understanding what partners and customers really need (Customer Focus); Opportunities to leverage (Partnerships); Opportunities for under-represented audiences (Diversity and Pipeline); and Evaluation (Evaluation).

ORGANIZATION:

Just as Mars missions have been organized into a program where each element strategically complements and builds on another, the Mars Public Engagement Plan will seek to create a focused, cohesive, highly leveraged program from its collection of planned activities. For greater synergy, Mars public engagement will be conducted at the Program level, covering all the individual missions scheduled for Mars destinations over the next two decades. This organization will prevent the need to "reinvent the wheel" with each mission, allow continuity in programming beyond the official end dates of missions, and provide the ability to develop strong, stable, long-lasting, and common infrastructures with long-term partners.

Principal Investigators receiving funding will be encouraged to coordinate their Education and Public Outreach efforts with the broader vision, goals, and objectives outlined in this plan. In the proposal-selection process, they may take advantage of pre-existing infrastructures for cost-sharing and cost-saving, as well as bring new and creative ideas to the program. Located all around the country, they represent a strong network of partners, able to act as local agents for the national program and to create unique and regionally relevant public engagement activities in their home areas.

Beginning in FY03, Mars Public Engagement will be funded at 1% of the Mars Program budget. For maximum impact, Mars public engagement will heavily rely on partnerships and alliances for outside expertise, dissemination opportunities, and existing

communications infrastructures, while focusing resources internally on four central assets the Mars Program brings to the table (i.e., its comparative advantage):

- the provision of high-quality images and visualizations based on real data that have the potential to create immersive experiences in places of public gathering;
- access to, and visibility of, scientists and engineers who can not only help tell the story of Mars exploration, but are themselves an inspiring part of it;
- the ability to perform a coordinating role for targeted collaboration among NASA centers involved in Mars exploration and with educational, museum, communications, and other potential partners; and,
- the leadership ability to incorporate public engagement priorities into the actual planning and implementation of missions.

To accord with the structure of Project Operating Plans (POPs) and other NASA reporting mechanisms, activities in this plan fall under four categories:

- **Crosscutting Activities**, or those efforts that equally serve formal education, informal education, and public outreach;
- **Formal Education**[*], or assessable academic and co-curricular instruction in accordance with federal, state, and local standards and with educational pedagogy covering K-12, community college, undergraduate, graduate, and post-doctoral education (including courses for future teachers);
- **Informal Education**[*], or non-academic, facilitated learning experiences outside classroom settings (sometimes using educational pedagogy) that typically occur through life-long-learning opportunities at organizations such as museums, science centers, planetaria, libraries, parks, co-curricular (after-school) programs, and youth, civic, and retiree groups; and,
- **Public Information and Outreach**, or products and activities that engage the general public, special interest groups, children, businesses, and other audiences.

Each of these areas will have specific areas of focus, or "threads," that will help provide clarity, center, and structure to the program. Activities organized under these threads will be identified as near-term (FY02 – FY04), mid-term (FY05 – FY10), or long-term (FY11 – FY20) projects, placed in a roadmap, and correlated with the Mars Program science and technology goals and the Mars Public Engagement goals, objectives, and values they serve. In brief, the threads for each category are:

[*] NASA Policy Directive 1392.1C defines "Education Program" as a generic term covering all individual and NASA-sponsored programs, activities, and projects conducted for or with educators and students in the formal and informal educational community. "Formal Education Community" is defined as a term covering individuals and institutions involved in K-4, 5-8, 9-12, community college, undergraduate, graduate, and postdoctoral. "Informal Education Community is defined as a term covering individuals and institutions involved with museums and science centers.

Crosscutting Activities: **Management** includes all plans, reviews, evaluations, and reports for Mars Public Engagement, as well as coordination with communications areas that are closely connected, but overseen elsewhere (e.g., risk communications). **Speaker Support** enhances the ability of Mars scientists and engineers to present at formal education, informal education, and public outreach events. **Visualizations** include art, animations, documentary footage, web movies, and other images that make Mars exploration come alive for all audiences. It also includes building the technical, infrastructural capability necessary for their timely and cost-effective delivery. **Community Input** covers initiatives that infuse the program with new ideas. It also includes participation by Principal Investigators whose science instruments and attendant education and public outreach proposals have been selected, as their proposed products and activities typically cross-cut all three public engagement categories.

Formal Education Threads: **Student Imaging and Analysis** will give students the opportunity to work with real Mars data. **Robotics Education** will give students experience with rover- and robotics-related science, technology, and mathematics. **Arts, Letters, & Humanities** will give students an opportunity to experience science and math through art, music, literature, and other humanities disciplines. **Workshops** will provide teachers and pre-service students planning to become teachers with professional development opportunities, standards-based classroom activities, as well as information about Mars, Mars missions, and opportunities to participate in programs under the other three threads.

Informal Education Threads: **Networks & Alliances** includes all efforts to disseminate information and images (particularly high-resolution, high-definition visualizations) throughout the informal education community, leveraging pre-existing and new networks to the fullest extent. **Models and Exhibits** covers model and exhibit loans and opportunities for the informal education community to buy in on new orders. **Informal Educator Professional Development Opportunities** include workshops, interviews, and other mechanisms for the informal education community to interact with Mars scientists, engineers, and educators so that they can keep apprised of the latest Mars science results and receive background information necessary for the development of their own programs and displays.

Public Information and Outreach Threads: **Internet Initiatives** and **Media Support Initiatives** make use of significant dissemination means to allow the public to access images and information in a seamless way. **Community-Building Initiatives** focus on projects that bring an understanding of Mars and participative activities to local communities. **Commercialization** will enable companies interested in Mars-related products (e.g., toys, computer games etc.) to reach even more people. In the long-term, subject to allowability and NASA policy, the goal will be to generate a revenue stream that can flow back into the Mars Public Engagement Program. Such funds would potentially generate an ability to invest in more science, engineering, mathematics, and other space-related education for the public over all, and for teachers and students in particular.

2.0 OVERVIEW

Mars exploration is NASA's signature effort in planetary science over the next two decades. It is one of the largest programs in NASA's Science Mission Directorate, and unlike any other program, provides regular and frequent voyages to the red planet. As a space-faring society, people can regard Mars exploration as one of the most prominent turn-of-the-millennium endeavors to step beyond our home planet and out into the cosmos.

Such a compelling program deserves equally forward-looking initiatives to engage the public in Mars exploration, scientific discoveries, and technological achievements. A guiding principle is that we should be as daring, wise, and path-finding in our public engagement efforts as we are in designing ambitious, yet achievable, missions. The benefit of a twenty-year plan is that public engagement can be intimately linked with the long-term goals of the Mars Program. Public engagement initiatives also have time to bear fruit. Looking out into the future with vision, boldness, and creativity will also provide an environment for encouraging openness and innovation in planning and implementation.

Mars Public Engagement will incorporate the four science goals of the Mars Exploration Program and its guiding theme of "Follow the Water" into its activities to the fullest extent possible. Details of Mars science goals, objectives, and investigations can be found in Appendix A. The four science goals are:

Science Goal One: Determine if Life ever Arose on Mars

On Earth, all forms of life need water to survive. It is likely, though not certain, that if life ever evolved on Mars, it did so in the presence of a long-standing supply of water. On Mars, we will therefore search for evidence of life in areas where liquid water was once stable, and below the surface where it still might exist today. Perhaps there might also be some current "hot spots" on Mars where hydrothermal pools (like those at Yellowstone) provide places for life.

In addition to liquid water, life also needs energy. Therefore, future missions will also be on the lookout for energy sources other than sunlight, since life on the surface of Mars is unlikely given the presence of "superoxides" that break down organic (carbon-based) molecules on which life is based. Here on Earth, we find life in many places where sunlight never reaches--at dark ocean depths, inside rocks, and deep below the surface. Chemical and geothermal energy, for example, are also energy sources used by life forms on Earth. Perhaps tiny, subsurface microbes on Mars could use such energy sources too. Microbes are the only form of life that would have had time to develop there.

NASA will also look for life on Mars by searching for telltale markers, or biosignatures, of current and past life. The element carbon, for instance, is a fundamental building block of life. Knowing where carbon is present and in what form would tell us a lot about where life might have developed. Most of the current martian atmosphere consists of

carbon dioxide. If carbonate minerals were formed on the martian surface by chemical reactions between water and the atmosphere, the presence of these minerals would be a clue that water had been present for a long time--perhaps long enough for life to have developed.

On Earth, fossils in sedimentary rock leave a record of past life. Based on studies on Earth, scientists have learned that only certain environments and types of deposits provide good places for preserving any record of life that might once have been there. On Mars, searches are already underway to locate lakes or streams that may have left behind similar deposits. So far, however, the kinds of biosignatures we know how to identify are those found on Earth. It is possible that life on another planet might be very different. The challenge is to be able to differentiate life from non-life no matter where one finds it, no matter what its varying chemistry, structure, and other characteristics might be. Life detection technologies under development will help us define life in non-Earth-centric terms so that we are able to detect in all the forms it might take.

Science Goal Two: Characterize the Climate of Mars

A top priority in the exploration of Mars is understanding its present climate, climate conditions in the distant past, and the causes of climate change over time. The current martian climate is regulated by seasonal changes of the carbon dioxide ice caps, the movement of large amounts of dust by the atmosphere. and the exchange of water vapor between the surface and the atmosphere. One of the most dynamic weather patterns on Mars is the generation of dust storms that generally occur in the southern spring and summer. These storms can grow to encompass the whole planet. Understanding how these storms develop and grow is one goal of future climatic studies. A better understanding of Mars' current climate will help scientists more effectively model its past climatic behavior.

To do that, detailed weather maps of the planet and information about how much dust and water vapor are in the atmosphere will be needed. Monitoring the planet for this information over one full martian year (687 Earth days) and longer will help us understand how Mars behaves over its seasonal cycle and guide us toward understanding how the planet changes over millions of years. The layered terrain of the martian polar regions also holds clues about the planet's past, much like the rings of a tree provide a record of its history. When and how were these polar layers deposited? Was the climate of Mars ever like that of Earth? And if so, what happened to change the planet into the dry, cold, barren desert it is today? Those are the questions that Mars missions still have to answer.

Science Goal Three: Characterize the Geology of Mars

How did Mars become the planet we see today? What accounts for the differences and similarities between Earth and Mars? These questions will be addressed by studying Mars' geology. The Mars Exploration Program is focused on understanding how the

relative roles of wind, water, volcanism, tectonics, cratering and other processes have acted to form and modify the martian surface.

A recent discovery by the Mars Global Surveyor spacecraft of large areas of magnetic materials on Mars indicates that the planet once had a magnetic field, much like Earth does today. Because magnetic fields in general act to shield planets from many forms of cosmic radiation, this discovery has important implications for the prospects of finding evidence of past life on the martian surface. Study of the ancient magnetic field also provides important information about the interior structure, temperature and composition of Mars in the past. The presence of magnetic fields also suggests that Mars was once more of a dynamic Earth-like planet than it is today.

Of fundamental importance are the age and composition of different types of rocks on the martian surface. Geologists use the age of rocks to determine the sequence of events in a planet's history. Composition information tells them what happened over time. Particularly important is the identification of rocks and minerals formed in the presence of water.

Water is one of the keys to whether life might have started on Mars. What other materials might be trapped in those rocks with information about the planet's history? How are the different rock types distributed across the surface? Future orbiting and landed missions will carry special tools designed to help answer these questions. Mars meteorites discovered on Earth can also provide clues about the planet.

Goal 4: Prepare for Human Exploration of Mars.

Getting astronauts to the martian surface and returning them safely to Earth is an extremely difficult engineering challenge. A thorough understanding of the martian environment is critical to the safe operation of equipment and to human health, so the Mars Exploration Program will begin to look at these challenges in the coming decade.

The safety of astronauts is of paramount importance to NASA. Mars lacks an ozone layer, which on Earth shields people from lethal doses of solar ultraviolet radiation. We do not have good information about the amount of ultraviolet radiation that reaches the martian surface. A more detailed understanding of the radiation environment will provide the information necessary to assess the effects of UV radiation on astronauts, as well as help engineers design protective space suits and habitats. The martian soil contains "superoxides" that, in the presence of ultraviolet radiation, break down organic molecules. While superoxides' effect on astronauts is probably not serious, their impact (and that of any other unique chemical aspects of the martian soil) must be assessed before human exploration of Mars can begin.

Robotic exploration will pave the way for the long-term possibility of human missions to Mars. Mars missions will seek to analyze the radiation environment on Mars and search for water resources that, if discovered, could be used to support future human explorers. Eventually, robotic spacecraft, rovers, and drills could be used to access water resources

in advance of, and during, human exploration. Advanced entry, descent and landing techniques that reduce the G-forces on landers will also be developed for spacecraft and astronaut safety.

Mars Technology

In addition to these science goals, Mars exploration depends on a long chain of technology development. Spacecraft and other enabling technologies allow scientific questions to be answered. The Mars Exploration Program continually invests in innovation, rigorously tests them here on Earth and in space, and applies them to missions. The technologies developed and tested in each mission enables even greater achievements in the missions that follow. These stories present fascinating glimpses into the Program that will engage public audiences along with Mars science, so will also be highlighted in communications with the public. They can also encourage students to pursue space-related and other high-tech careers in a variety of fields that contribute to a strong economy—robotics, computing, engineering, and others.

2.1 MARS PUBLIC ENGAGEMENT VISION

Mars Public Engagement has a two-part vision that will guide the planning and implementation of all activities:

- Sharing the Adventure; and,
- Making Mars a Real Place.

Sharing the Adventure means that real opportunities will be created for the public not only to follow along, but also to participate directly and interactively in Mars exploration. Sharing the Adventure will be focused on the creation of real and engaging opportunities for direct public participation. Such activities can range all the way from naming contests to actual opportunities for students to conduct science experiments at Mars. It will include innovative opportunities for students, teachers, and the wider public to interact with scientists and engineers who make the journey of discovery come alive and inspire future generations to follow in their footsteps.

Making Mars a Real Place means providing the public with direct and "virtual" experiences with the red planet in a way that turns Mars from a series of returned images to something that is as psychologically real as someone's backyard. Mars is not only a real place, but also a destination, first for robotic spacecraft and, perhaps one day far in the future, for humans. It is the only other planet in our solar system on which humans could potentially exist. It has many similar features to those on Earth, yet is a harsh and alien planet, full of surprises and challenges. Giving people a virtual experience of being on the planet through visualizations—art; animations; documentaries; big-screen, high-definition projections, real-time or near-real-time access to data—is a high priority.

2.2 LONG-TERM GOALS AND SUPPORTING OBJECTIVES

In order to support the vision of Sharing the Adventure and Making Mars a Real Place, it is important to reach out broadly, and also to provide a sense that the connection is personally meaningful. Abundant opportunities for the public to participate directly in the experience of Mars exploration will assist in that, as will strong connections to schools, museums, civic organizations, homes, and other community centers and places where people live their lives. To achieve the vision, all Mars Public Engagement activities will be selected and managed with the following goals in mind:

Goal 1: Communicate the story of Mars Exploration in a way that builds on enduring human themes (e.g., the challenges and the triumphs of voyaging into the unknown) and focuses on the discovery of new knowledge through pursuit of the Program's science and technology goals;

Goal 2: Improve and rigorously evaluate our programs to assure our contributions are reaching diverse student populations and equitably enhancing the quality of science, mathematics, and technology education for all Americans;

Goal 3: Provide timely, accurate information that responds to public interest in mission safety (including the use of various power sources, sample returns, and planetary protection at Mars and on Earth);

Goal 4: Create the means for direct public involvement in missions and programs; and,

Goal 5: Ensure the continuous infusion of new ideas in programming.

Objectives supporting these goals include:

Objective 1: Support the development of high-definition visualizations and other immersive experiences in classrooms, museums, and other places of public gathering;

Objective 2: Build strong networks, in cooperation with scientists and engineers and with education, museum, and communications leaders and organizations, that allow new Mars knowledge, images, and visualizations to be experienced by audiences nationwide;

Objective 3: Integrate Mars science with other areas of knowledge (art, music, etc.) that together make an enriched and compelling human experience;

Objective 4: Invest in programs and infrastructures that promote easy access for customers (e.g., one-stop shop for classrooms; dedicated servers and direct down-links for museums);

Objective 5: Encourage "public engagement payloads" (e.g., cameras and other experiential software and hardware) in missions; and,

Objective 6: Provide more real-time (or near-real-time) data and more opportunities for public interactions with Mars experts nationwide.

2.3 KEY VALUES

In meeting these objectives, Mars Public Engagement will actively respond to principles laid out in NASA's Office of Space Science Strategic Plan, November 2000 (Appendix C), as well as recommendations found in two principal guiding documents:

- Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs (1995); and,
- Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy (1996).

Especially important are the following five principles: 1) participation by scientists and engineers; 2) understanding what partners and customers really need; 3) opportunities to leverage; 4) opportunities for under-represented audiences; and, 5) evaluation. In this plan, they are listed as **values** that cross-cut all objectives, rather than as objectives in and of themselves, because they are critical components of all activities and inseparable from the successful implementation of Mars Public Engagement.

The Mars Public Engagement Plan's five *Key Values* also correlate with Operating Principles in the 2003 NASA Education Enterprise Strategy, which are used in NASA Office of Education evaluative reviews as performance indicators (see also Appendix I).

Key Value	Corresponding Operating Principle
Participation by scientists and engineers	Content
Understanding what partners and customers really need	Customer Focus
Opportunities to leverage	Partnerships
Opportunities for under-represented audiences	Diversity & Pipeline
Evaluation	Evaluation

Value 1: Participation by Scientists and Engineers:

The community of scientists, engineers, and support staff working in the Mars Exploration Program can make significant and measurable contributions in the planning and implementation of Mars public engagement activities. The mission team members have a special and important role in enhancing scientific and technological literacy throughout the country, as they are role models for the next generation of space explorers,

and can serve as mentors for both students and educators. Opportunities also abound in speaking opportunities, web chats, materials review, media interviews, and responses to public inquiries.

In response to suggestions from the Mars science and engineering community, Mars Public Engagement staff will:

- engage in a collaborative process in creating new plans, products, and activities and widely publish lists of upcoming opportunities;

- work with scientists and engineers to match their particular strengths and interests to on-going public engagement activities and roles (content provider, speaker, reviewer) in a way that maximizes their expertise and desired way of participating;

- provide products and services (e.g., speaker kits with updated slide sets etc.) requested by the community that will make participation easier and more enjoyable; and,

- organize training workshops with external experts who will deliver an understanding of age- and experience-appropriate communications with students and the general public.

Principal Investigators receiving funding are encouraged to coordinate their Education and Public Outreach efforts with the broader vision, goals, and objectives outlined in this plan. They may take advantage of pre-existing infrastructures for cost-sharing and cost–saving, as well as bring new and creative ideas to the program. Located all around the country, they represent a strong network of partners, able to act as local agents for the national program and to create unique and regionally relevant public engagement activities in their home areas.

Because making connections can be time intensive, Mars public engagement staff will also play a part in connecting Mars scientists and engineers around the country with contacts in schools, museums, youth groups, and other programs in their individual geographical regions. To accomplish this most effectively, Mars Public Engagement staff will continue to deepen relationships with the Space Science Support Network, which is chartered by NASA to create and maintain extensive connections nationwide. Capturing the contributions of scientists and engineers through documentary-style features will also be pursued.

Mars Public Engagement staff will also continue to interact regularly with the mission teams by attending key staff meetings and with the wider group of project science teams through presentations and participation in Project Science Group (PSG) meetings. Mars Public Engagement staff will build on current relationships with scientists and engineers in order to receive their continuous input and reviews of content and materials. In producing products in FY01, numerous scientists and engineers participated in content development. The response rate from the Mars community to web and outreach product

beta testing was roughly 10% of those who were asked for input (roughly 30-50 of 300-500 asked on each occasion). Mars Public Engagement staff will use these initial response and participation rates as a baseline to build upon. That year, about 150 Mars scientists and engineers were actively involved in all aspects of public engagement in a wide variety of roles ranging from public speaking to mentors to content reviewers.

Expanding on relationships built through participation in Project Science Group meetings and in break-out sessions focused specifically on public engagement, Mars Public Engagement staff will actively seek to include scientists and engineers in planned "innovation and feedback workshops" (see Section 3.2.2) that will bring together a variety of external experts. These workshops will infuse the Mars Public Engagement program with new ideas and best practices (see Section 3.4.4).

Value 2: Opportunities for Under-represented Audiences:

Educational equity is one of the highest priorities for NASA and for the nation. Mars public engagement will aggressively seek ways to encourage participation by under-represented minorities, women, and people with disabilities in our programs. Partnerships with Historically Black Colleges and Universities, Hispanic Serving Institutions, and Tribal Colleges will be sought with the intent of enhancing faculty and student capabilities and providing opportunities for real mission work. In particular, reaching pre-service teachers in these institutions can enhance familiarity with available NASA/Mars resources and communicate ways they can participate and contribute.

Building on recent successes with the Spanish-language press (broadcast and print), new relationships with under-represented and minority press will be actively pursued to reach the widest audience possible. As much as possible, press opportunities will be made in multiple languages, drawing on the rich backgrounds of the people who work in the Mars program. Featuring cultural, language, ethnic, gender, and other diversity does more than bring Mars exploration to people who wouldn't otherwise learn of it. It will also inspire children to believe that they too could become scientists, engineers, technicians, artists, accountants, or any of the numerous positions available in space exploration, regardless of their individual backgrounds.

Collaborations with international partners who are participating in Mars Program activities are also key to ensuring a vibrant, culturally rich program. Coordinating public engagement efforts and opening the door to new relationships could result in significant leverage and cohesion, plus underscore the idea that nations can peacefully cooperate in pursuit of great and inspiring goals.

In reaching out to under-represented audiences, working with already established networks that reach into urban, rural, and other under-represented communities is also vital. Mars Public Engagement will work closely with the Space Science Forums, the Space Science Broker/Facilitators in the Support Network, and other NASA programs that can greatly assist in making new connections. Partnerships with state, national, and nonprofit organizations serving these communities remain a largely untapped resource,

and much more can be done to explore opportunities for both new partnerships and greater inclusion in existing programs. In all programming, representatives of under-represented communities will be included in the planning, implementation, and review of products and activities, to ensure the widest possible access to Mars-related information and programs. All activities will be evaluated in terms of impact and reach to under-represented constituencies.

Value 3: Understanding What Our Partners and Constituencies Really Need

It is important to understanding what our partners and constituencies really need if NASA is to assist them in doing their jobs as they define them. Mars Public Engagement will make an up-front investment in asking our diverse constituencies— educators, students, schools, school districts, education associations, museums, science centers, planetaria, libraries, media, and others—what is most useful and engaging to them and their audiences. Workshops focused on both innovation and "best practices" will enable us to make sure that our efforts are as productive as possible. The key is to listen to the "people who communicate with people" and learn from their professionalism and expertise, while sharing NASA connections and knowledge. Such interactions will ensure that communications and educational materials are provided in an understandable, easy-to-use, and easy-to-access manner, which will in turn increase the likelihood that they will be used widely.

From previous discussions with experts, it is clear that the greatest challenge will be to individualize and personalize relationships and products with limited staff and budgets. Feedback suggests that some "mass produced" products and activities will work, but that specialized, personal events and products are highly desirable. That is true not only for different constituencies (formal education, informal education, media, internet, and other audiences), but also for members within them (i.e., it is a mistake to think every school or museum is exactly alike). In essence, the message back to NASA/JPL is not to assume homogeneity within a specific group, but to plan and allow for diversity in our programs and interactions. At the same time, creating easy-to-access "one-stop shops" and entry points are desirable for enabling efficient individual (and small group) efforts to emerge. Timeliness, quality, and clear communications are important to all audience groups.

Effective public engagement depends on understanding the interests of our constituencies and responding to them. By understanding the goals of our potential partners and customers and working with them from the beginning, NASA/Mars Public Engagement and partners can identify mutually beneficial projects with high payoffs. To get the most out of Mars programs, our shareholders should have a voice not only in the adventure, but also in crafting and evaluating it at well. The message from NASA/Mars Public Engagement should be, "We asked because we wanted to know. Here's what you said, and here's how we're responding to it."

Value 4: Seek Opportunities to Leverage Resources Around Common Goals

One central strategy is to employ an integrated communications approach, making use of every resource possible. The idea of partnership begins with drawing upon expertise residing within the entire Mars community (universities, industry partners, NASA, JPL and other NASA Centers). Only by building on the strengths and areas of synergy of the Mars community will we be able to bring more to the table in forming external alliances. Collaborations are therefore crucial among various outreach, education, audio/visual, public services, media relations, engineering, and science departments in the wider community.

With that in mind, a focused Mars Public Engagement team has been established (see Appendix H). This team will proactively look for opportunities to leverage resources and expertise through partnerships with: other NASA centers conducting Mars-related work; complementary Earth and Solar System missions; the Human Exploration and Development of Space Enterprise; the Deep Space Network; and, our international mission partners.

With this solid base, the team will seek high-impact opportunities to work with large networks of educators, curators, youth-group leaders, news media, the entertainment industry, and other interested businesses, organizations, and individuals. The goal is to establish projects that extend and multiply the benefits of Mars programs, serving the needs and interests of our partners as well as the public.

Value 5: Evaluation

To ensure quality, impact, and effectiveness, evaluation will be a central part of all phases of a product or activity, from design to dissemination. Each effort will have specific long-term goals identified, with clear benchmarks for evaluating progress toward those goals. Working through NASA's Solar System Exploration Forum, Mars Public Engagement will capitalize on evaluation and reporting infrastructures set up by NASA. At least one competed contract will be offered with an independent firm or organization for the purpose of providing formative and summative evaluations, advice on ways to make continual improvements, and the identification of gaps to be filled. Evaluation will also be built into individual activities so that participants can provide feedback. Ongoing working groups of relevant experts will help assess progress in relation to goals and objectives, as well as to allow new ideas to be incorporated (see Section 3.2.2).

Mars public engagement activities will also be assessed for their contributions to annual NASA performance targets and to the Science Mission Directorate's strategic priorities. Mars Public Engagement will make timely inputs to NASA's tracking and reporting system (NEEIS). Effectiveness will be regularly evaluated through the NASA Office of Education, the JPL Educational Affairs Office, and other cognizant offices. Reviews and evaluations will be held at least annually.

2.4 ORGANIZATION

Just as Mars missions have been organized into a program where each element strategically complements and builds on another, the Mars Public Engagement Plan seeks to create a focused, cohesive, highly leveraged program from its collection of planned activities. For greater synergy, Mars public engagement will be conducted at the Program level, covering all the individual missions scheduled for Mars destinations over the next two decades (see Appendix B). This organization will prevent the need to "reinvent the wheel" with each mission, allow continuity in programming beyond the official end dates of missions, and provide the ability to develop strong, stable, long-lasting, and common infrastructures with long-term partners.

Principal Investigators receiving funding are encouraged to coordinate their Education and Public Outreach efforts with the broader vision, goals, and objectives outlined in this plan. They may take advantage of pre-existing infrastructures for cost-sharing and cost-saving, as well as bring new and creative ideas to the program. Located all around the country, they represent a strong network of partners, able to act as local agents for the national program and to create unique and regionally relevant public engagement activities in their home areas.

Beginning in FY03, Mars Public Engagement will be funded at 1% of the Mars Program budget. For maximum impact, Mars Public Engagement staff will heavily rely on partnerships and alliances for outside expertise, dissemination opportunities, and existing communications infrastructures, while focusing resources internally on four central assets the Mars Program brings to the table (i.e., its comparative advantage):

- the provision of high-quality images and visualizations based on real data that have the potential to create immersive experiences in places of public gathering;
- access to, and visibility of, scientists and engineers who can not only help tell the story of Mars exploration, but are themselves an inspiring part of it;
- the ability to perform a coordinating role for targeted collaboration among NASA centers involved in Mars exploration and with educational, museum, communications, and other potential partners; and,
- the leadership ability to incorporate public engagement priorities into the actual planning and implementation of missions.

Partnerships will be sought at every opportunity to expand our reach, and proposal solicitations will enable new ideas to infuse the program with strength and innovation.

To accord with the structure of Project Operating Plans (POPs) and other NASA reporting mechanisms, activities in this plan fall under four categories:

- **Crosscutting Activities**, or those efforts that equally serve formal education, informal education, and public outreach;

- **Formal Education**[*], or assessable academic and co-curricular instruction in accordance with federal, state, and local standards and with educational pedagogy. covering K-12, community college, undergraduate, and graduate education (including courses for future teachers);

- **Informal Education**[*], or non-academic, facilitated learning experiences outside classroom settings (sometimes using educational pedagogy) that typically occur through life-long-learning opportunities at organizations such as museums, science centers, planetaria, libraries, parks, co-curricular (after-school) programs, and youth, civic, and retiree groups etc.; and,

- **Public Information and Outreach**, or products and activities that engage the general public, special interest groups, children, businesses, and other audiences.

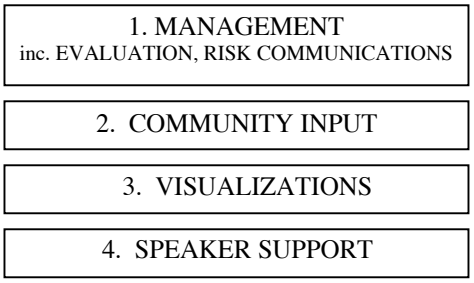
Each of these areas will have specific areas of focus, or "threads," that will help provide clarity, center, and structure to the program. Activities organized under these threads will be identified as near-term, mid-term, or long-term projects, placed in a roadmap, and identified in terms of the Mars Program science and technology goals and the Mars Public Engagement Objectives and Values they serve. In brief, the threads for each category are:

Crosscutting Activities: **Management** includes all plans, reviews, evaluations, and reports for Mars Public Engagement. It also includes coordination with communications areas that are closely connected, but overseen elsewhere (e.g., risk communications). **Speaker Support** enhances the ability of Mars scientists and engineers to present at formal education, informal education, and public outreach events. **Visualizations** include art, animations (science and spacecraft), documentary footage, web movies, and other images that make Mars exploration come alive for all audiences. It also includes building the technical, infrastructural capability necessary for their timely and cost-effective delivery. **Community Input** covers initiatives that infuse the program with new ideas. It also includes participation by Principal Investigators whose science

[*] NASA Policy Directive 1392.1C defines "Education Program" as a generic term covering all individual and NASA-sponsored programs, activities, and projects conducted for or with educators and students in the formal and informal educational community. "Formal Education Community" is defined as a term covering individuals and institutions involved in K-4, 5-8, 9-12, community college, undergraduate, graduate, and postdoctoral. "Informal Education Community is defined as a term covering individuals and institutions involved with museums and science centers.

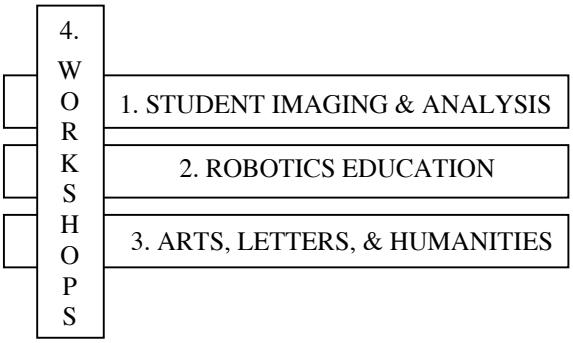
instruments and attendant education and public outreach proposals have been selected, as their proposed products and activities typically cross-cut all three public engagement categories.

CROSSCUTTING ACTIVITIES THREADS



Formal Education Threads: **Student Imaging and Analysis** will give students the opportunity to work with real Mars data. **Robotics Education** will give students experience with rover- and robotics-related science, technology, and mathematics. **Arts, Letters, & Humanities** will give students an opportunity to experience science and math through art, music, literature, and other humanities disciplines. **Workshops** will provide teachers and pre-service students planning to become teachers with professional development opportunities, standards-based classroom activities, and information about Mars, Mars missions, and opportunities to participate in programs under the other three threads.

FORMAL EDUCATION THREADS



Informal Education Threads: **Networks & Alliances** includes all efforts to disseminate information and images (particularly high-resolution, high-definition visualizations) throughout the informal education community, leveraging pre-existing and new networks to the fullest extent. **Models and Exhibits** covers model and exhibit loans and opportunities for the informal education community to buy in on new orders. **Informal Educator Professional Development Opportunities** include workshops, interviews, and other mechanisms for the informal education community to interact with Mars scientists,

engineers, and educators so that they can keep apprised of the latest Mars science results and receive background information necessary for the development of their own programs and displays.

INFORMAL EDUCATION THREADS

1. NETWORKS & ALLIANCES

2. MODELS & EXHIBITS

3. INFORMAL EDUCATOR PROFESSIONAL DEVELOPMENT OPPORTUNITIES

Public Information and Outreach Threads: **Internet Initiatives** and **Media Support Initiatives** make use of significant dissemination means to allow the public to access images and information in a seamless way. **Community-Building Initiatives** focus on projects that bring an understanding of Mars and participative activities to local communities. **Commercialization** will enable companies interested in Mars-related products (e.g., toys, computer games etc.) to reach even more people. In the long-term, subject to allowability and NASA policy, the goal will be to generate a revenue stream that can flow back into the Mars Public Engagement Program. Such funds would potentially generate an ability to invest in more science, engineering, mathematics, and other space-related education for the public over all, and for teachers and students in particular.

PUBLIC OUTREACH THREADS

1. INTERNET INITIATIVES

2. MEDIA INITIATIVES

3. COMMUNITY-BUILDING INITIATIVES

4. COMMERCIALIZATION

3.0 PLANNED ACTIVITIES

The following section provides an overview of planned activities, with a focus on those in the near-term (FY02-FY04) and suggestions of possible ideas for the mid-term (FY05-FY10) to long-term (FY11-FY20). For an understanding of how these dates accord with missions in the Mars Program, see Appendix B.

Planned activities are organized into four categories: Crosscutting, Formal Education, Informal Education, and Public Information and Outreach. A summary roadmap of planned activities can be found in Appendix D. A summary chart of how each near-term activity contributes to meeting the goals and objectives in this plan can be found in Appendix E.

This plan, like any other, is intended to be a "living document" and is subject to change based on new direction from NASA HQ and the Mars Exploration Program Management; unforecasted, not-to-be-missed opportunities that provide high leverage; and the results of evaluation efforts.

3.1 INTRODUCTION TO CROSSCUTTING ACTIVITIES

Crosscutting activities are defined as efforts that equally serve Formal Education, Informal Education, and Public Information and Outreach. In this plan, it includes four areas: Management (including coordination with risk communications efforts and oversight of all plans, reviews, reports, and evaluations), Community Input, Visualizations, and Speaker Support.

Management: Plans, Reviews, Reports and Evaluations

Management of Mars Public Engagement will be approached with the same rigor as management of the Mars Exploration Program and its missions. Annual implementation plans (with a Work Breakdown Structure and Work Agreements) and task plans will be created. Mars Public Engagement staff will participate in "Critical Events Readiness Reviews" held by missions, and will hold their own as needed. Progress toward public engagement goals will be detailed at quarterly reviews (GPMCs). Evaluation will be a part of all activities, from the first stages of development to implementation. It will involve education and communications experts, scientists and engineers, and representatives of under-represented communities. Strategic, independent analyses will also ensure the long-term health and strength of programming, and allow for new ideas. An annual analysis of performance in relation to the goals set out in this plan, in annual implementation plans, and by NASA performance indicators will also be reported. All products and activities will be entered into NASA's tracking and reporting system (NEEIS). Mars Public Engagement team members will continue to interact regularly with the missions by attending key mission meetings and with the project science teams through presentations and participation in Project Science Group (PSG) meetings.

Mars public engagement staff will also participate in the early planning and definition of missions to highlight potential public engagement opportunities. For example, the idea of having "public engagement payloads" in addition to science payloads is increasingly taking root. Cameras on launch vehicles, CDs carrying signatures, and student science experiments are all part of that trend. So far, however, these efforts have been largely ad hoc and relatively spontaneous in nature. If incorporated into planning early enough, missions potentially beginning with the Mars Science Laboratory mission might have a opportunity to push the envelope in public engagement activities. In an extended mission phase, to give one "outside-the-box" example, a rover optimized for collecting and piling up rocks for a sample return could create patterned geoglyphs or cairns that would remain on the surface as a symbol of our collective aspirations as a planet-exploring society. It could be imaged by orbiters, and might even be visited much later by eventual human visitors to the planet. And here on Earth, similar marks of astronomical significance made by people throughout history could be remembered to illustrate humankind's longtime and fundamental curiosity about the universe and quest for new knowledge. Regardless of the eventual ideas offered and selected, significant progress is being made in integrating public engagement concepts at the preliminary mission stages when they can be more easily and cost-effectively accommodated. The next step is to establish a group that can take a coherent look at the opportunities and carefully assess the highest-impact opportunities that are relevant and exciting to audiences.

Management: Communicating the Risks and Challenges

Management will also cover joint planning and coordination on "risk communication," defined as informing the public about the use of nuclear power sources on Mars missions, sample returns, and other issues that might be of concern. Overall coordination for risk communication is the responsibility of the JPL Risk Communication Coordinator, who will create a Mars Program Risk Communication Plan, working closely in concert with launch approval and planetary-protection staff throughout NASA. Select members of the Mars Public Engagement Team will participate in all risk communication planning and reviews and will assist in the creation of understandable information for the public. For all such communications, it is very important to be proactive in addressing public issues, not to convince, but simply to provide straightforward, responsive, and honest answers to inquiries and concerns.

To cross-reference, a key element in the Mars Exploration Program Risk Communication Plan is to earn and maintain the public's trust. It is a multi-Center plan, meaning that it coordinates messages and activities throughout the NASA community. Key scientists, engineers, managers, and communications experts have all been involved in planning, and will continue to contribute their expertise throughout the implementation of the Mars Exploration Program and its component missions. The Mars Exploration Program Risk Communication Plan includes the identification of key people, their roles and responsibilities, and a process for decision-making and communications.

Community Input

Community input from scientists, engineers, educators (formal and informal), and communications experts will be regularly sought. Outside expertise and advice will be particularly important in defining mid-term and long-term programs, as well as in amending near-term activities for greater effectiveness. Members of under-represented communities will be a part of all planning and evaluation, in program-wide analysis and in individual activities, to make sure Mars Public Engagement activities are well-suited for diverse audiences. The JPL Minority Affairs Manager, who is a liaison on the Mars Public Engagement Team, will actively work on making recommendations and building relationships for greater inclusion. Workshops will be held to bring all communications, science and engineering, education, and under-represented experts together. By working with the Solar System Exploration Forum, it might be possible to leverage resources and the time of well-known experts by partnering with other solar system missions to sponsor regular workshops with theme- or planet-focused sessions within them. Community input also includes funding for the contributions Principal Investigators will be making per their selected education and public outreach proposals. It will also include proposal solicitations similar to "IDEAS" grants.

Visualizations and Speaker Support

Two other activities will be also be treated as cross-cutting in nature: speaker support and visualizations. Science and engineering speakers are requested for everything from educator workshops to public talks to media interviews, and contribute to all aspects of public engagement. In addition to good stories, we also need good people who can explain things well. It would be a great advantage to have a "spacecaster" who can fill people in on the events of the moment, or perhaps even a robot "Carl Sagan." Visualizations--artwork, animations, documentary footage, and other imagery--are used by members of the media, educators, internet users, museums, publishers, and viewers at home; in short, everyone. Imaging Mars has come a long way since the Mariner missions, but compared to Hollywood's contemporary effects, we are barely state-of-the-art in our portrayals of places like the red planet. The Mars Public Engagement team intends to stress high-definition images and 3-D animations in the future, for such imagery remains in the public's memory long after the printed word has faded.

3.2 PLANNED CROSSCUTTING ACTIVITIES

Key Crosscutting activities are organized by focus areas, or "threads." Following a brief description, a "mini-roadmap" is provided for each activity (extracted from the overall roadmap in Appendix D for easy referencing).

3.2.1 Crosscutting Thread 1: Management

ACTIVITY A: COMPREHENSIVE PLANS, REVIEWS, REPORTS, & EVALUATION

The Mars Public Engagement team will fulfill its responsibilities in ensuring sufficient planning, reviewing, evaluating, and reporting. Management of Mars Public Engagement will be approached with the same rigor as management of the Mars Exploration Program and its missions. Annual implementation plans (with a Work Breakdown Structure and Work Agreements) and task plans will be created. Mars Public Engagement staff will participate in "Critical Events Readiness Reviews" held by missions, and will hold their own as needed. Progress toward goals will be detailed at quarterly reviews (GPMCs).

Staff will continue to work with the mission teams and their Project Science Groups. Participation in the early planning and definition of missions will also be pursued, in close working relationships with the Mars science and engineering community.

Working through NASA's Solar System Exploration Forum, Mars Public Engagement will capitalize on evaluation and reporting infrastructures set up by NASA. At least one competed contract will be created for an independent organization to conduct formative and summative evaluations, advise on ways to make continual improvements, and identify gaps to be filled. Evaluation will also be built into individual activities so that participants can provide feedback. Ongoing working groups of relevant experts will help assess progress in relation to goals and objectives, as well as to allow new ideas to be incorporated (see Section 3.2.2).

Mars Public Engagement activities will also be assessed for their contributions to annual NASA performance targets and to the Science Mission Directorate's strategic priorities. Mars Public Engagement will make timely inputs to NASA's tracking and reporting system (NEEIS). Effectiveness will be regularly evaluated through the NASA Office of Education, the JPL Educational Affairs Office, and other cognizant offices. Reviews and evaluations will be held at least annually. See Appendix K for review summaries.

This activity is intended to ensure that the vision, values, goals, and objectives in this plan are met to the highest extent possible. For alignment of this activity to goals and objectives outlined in this plan, see Appendix E. This activity is also aligned with NASA Strategic Goals 6 and 7 and with all NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity A: COMPREHENSIVE PLANS, REVIEWS, REPORTS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Continue to improve upon use of the WBS, WA, and other management systems, work with mission teams and scientists collaboratively, and establish evaluation process.	Show solid impact as a result of programming and improvements to Mars Public Engagement per evaluations.	

ACTIVITY B: RISK COMMUNICATION

Risk Communication includes informing the public about the use of nuclear power sources on Mars missions, sample returns, and other issues that might be of concern. Risk Communication is managed by the JPL Risk Communications Coordinator, a member of the Cross-Program Launch Approval Engineering office. The Risk Communication Coordinator is responsible for coordinating among NASA HQ, the Mars Exploration Program Office, the Department of Energy, and other Risk Communication Points of Contact (including those on the Mars Public Engagement team). An overall plan for Risk Communications is laid out in the December, 2001 "Office of Space Science Risk Communications Plan for the Mars Program" (as updated in 2005 as "Mars Exploration Program Risk Communication Plan").

To cross-reference that plan, the goals of Mars Risk Communication are:

- Give the public many opportunities to join in the adventure of Mars exploration;
- Earn and maintain the public's confidence; and,
- Actively seek the opinion of diverse publics.

Guiding Principles for Risk Communication are:

Principle 1: Be transparent:

- Stay responsibly open, candid, and honest;
- Share information freely and as soon as possible;
- Use plain language; and,
- Continue being transparent, especially when sharing information about risks, benefits, and programmatic changes and failures.

Principle 2: Be inclusive

- Actively seek as many perspectives as possible; and,
- Be sensitive to cultural differences.

Principle 3: Be interactive

- Listen to colleagues, critics, and supporters;
- Be clear where NASA can/is willing to take input; and,
- Based on input, be open to modifications or new options.

In coordination with the JPL Risk Communications Coordinator, NASA's Office of Public Affairs, and NASA's Office of Education, select Mars Public Engagement staff will serve on a Risk Communication team (see Appendix H). They will contribute their

expertise to the creation and dissemination of informational and educational products, as outlined by section 3.2.8 in the "Mars Exploration Program Risk Communication Plan."

As this section states, a process has been developed to address issues of public concern quickly and accurately. Web sites with the most up-to-date information will be maintained by the JPL Risk Communication Coordinator for the general public, but there is often a need to respond appropriately to schools. A primary and secondary educational quick response capability will be created. This capability will be based on the use of packets of prepared materials that will be developed and sent to each of the regional Educator Resource Center Network Coordinators who normally distribute NASA educational outreach materials. These packets will contain educationally appropriate material about issues that are of potential concern. Packets will be developed for primary, secondary, and college levels. These packets will be sent to all educators who request information on the issues covered by the Risk Communication Plan.

Mars Public Engagement staff will provide the educational packets and/or letters to NASA's Office of Education when questions or issues are directed to that office. They will also work with international partners to enable translations of educational materials in languages recommended by the international partners for their use. The materials will also have a section geared to aiding the students with research on various aspects of the missions.

This Activity is intended to ensure that the vision, values, goals, and objectives in this plan are met to the highest extent possible. It particularly meets Goal 3 (Communicate Mission Safety) through Objective 2 (Strong Networks), Objective 4 (Easy, Assured Access), and Objective 6 (Real-Time Data and Information and Real-time Expert Interactions). It additionally supports Goal 1 (Communicate Story of Mars Exploration), Goal 2 (Diversity and Educational Equity) through the dissemination of educational products and the openness to diverse and multicultural views, and Goal 4 (Direct Public Involvement) through potential briefings and town halls.

It is additionally responsive to NASA Strategic Goal 6 (Objectives 6.1.1, 6.1.2) and Goal 7 (Objectives 7.1.1, 7.1.2, 7.1.3) and NASA Office of Education operating principles A (Customer Focus) and B (Content) in particular. See Appendices I and J.

<table>
<tr><th colspan="3">ROADMAP
Activity B: RISK COMMUNICATIONS</th></tr>
<tr><th>Near-term (FY02-FY04)</th><th>Mid-term (FY05-FY10)</th><th>Long-term (FY11-FY20)</th></tr>
<tr><td>In cooperation with the JPL Risk Communication Coordinator and other responsible parties, develop and disseminate risk communication materials and contribute to joint risk communications planning.</td><td colspan="2">Contribute to, and participate in, activities outlined in the developing Mars Risk Communications Plan (potentially including public meetings and briefings).</td></tr>
</table>

3.2.2 Crosscutting Thread 2: Community Input

ACTIVITY A: INNOVATION AND FEEDBACK WORKSHOPS & ADVISORY BOARD

Along with an Advisory Board, innovation and feedback workshops are intended to bring together education, communications, and science and engineering experts for regular advice on the content of the program and ways in which to infuse it with new ideas and expertise. Outside expertise and advice will be particularly important in defining mid-term and long-term programs, as well as in amending near-term activities for greater effectiveness. Participants from under-represented communities will be a part of all planning and evaluation, in program-wide analysis, and in individual activities to make sure they are well-suited for diverse audiences. The JPL Minority Affairs Manager, who is a liaison on the Mars Public Engagement Team, will actively work on making recommendations and building relationships for greater inclusion. Workshops will be held to bring all communications, science and engineering, education, and under-represented experts together. By working with the Solar System Exploration Forum, it might be possible to leverage resources and the time of well-known experts by partnering with other solar system missions to sponsor regular workshops with theme- or planet-focused sessions within them.

In the near-term, the goal is to design (with external input) the best process for this activity and set up the infrastructure for workshops and board meetings to take place over all phases of programming. The Solar System Exploration Forum will assist in identifying participants and in potentially sponsoring community-wide workshops with theme-focused sessions. This collaboration would enable multiple missions to share costs in running these continuing workshops. In the long-term, the goal is to utilize the input effectively and to show solid and sustainable results from recommendations offered.

To begin with, initial innovation and feedback workshops in FY02 and FY03 will be highly focused, as many activities in this plan are in a start-up or near-start-up phase, and will require the kind of "jump start" that only a highly focused set of expert participants can give. For example, the museum Visualization Alliance (see section 3.6.1, Activity A) will initially involve a small set of "founding members" who can help guide the initial organization of the alliance in a way that represents not only them, but the wider community. With this focused, highly expert, representative group, there is a greater likelihood that the alliance will be able to welcome large numbers of future partners in a well-organized, efficient way and in a manner that reflects in advance the needs and expectations of the informal education community. These highly topical innovation and feedback workshops will, of course, also involve appropriate levels of representation from the mission science and engineering teams, as well as any other participants deemed necessary to the success of the workshop and implementation of the activity it addresses.

Once greater organization and direction has been achieved through these initial planning and "start-up" workshops, a standing Advisory Board will be formed. This Advisory Board will meet once a year to provide advice and guidance on the overall program, and to review continuing advice that is collected through ongoing innovation and feedback workshops. The Advisory Board will include representatives from the science and engineering community, formal education, informal education, and other communications and management fields that will enhance the overall potential of Mars Public Engagement activities.

Advisors participating on the board and in workshops will provide input on the best ways of promoting this plan's vision of Sharing the Adventure and Making Mars a Real Place. This Activity primary supports Goal 2 (Diversity and Educational Equity) and Goal 5 (Infusion of New Ideas) through Objective 2 (Strong Networks) and Objective 4 (Easy, Assured Access). See also Appendix E.

It supports NASA Strategic Goals 6 and 7 and relates to all NASA Office of Education operating principles, but particularly: A (Customer Focus), B (Content), and E (Evaluation). See Appendices I and J.

ROADMAP ACTIVITY A: INNOVATION AND FEEDBACK WORKSHOPS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Form Advisory Board and design and begin implementing innovation and feedback workshops that allow external experts, customers, and partners (including scientists) to infuse the program with new ideas and best practices.	Continually assess ways of enhancing the workshops and board meetings per participant evaluation and demonstrate that advice was successfully incorporated into programming.	

ACTIVITY B: PROPOSAL SOLICITATIONS

A competitive proposal solicitation (similar to the NASA IDEAS Grants) will seek innovative public engagement proposals that: reach out to diverse audiences and geographic regions; take advantage of new technologies; and bring in new ideas and approaches. Offering such an opportunity is the fairest way to handle the numerous unsolicited requests for funding, and also allows for continuous innovation to be infused into the program. This part of the public engagement program will be scaleable, depending on the available budget. Awards may be one-year or multi-year in scope, and will be selected by a committee of education, communications, and science and engineering representatives.

In the near-term (FY02-FY04), the goal is to define a well-thought-out process (with external input from representatives who would likely propose or who have already submitted unsolicited proposals, as well as from other NASA groups that have experience

in running such proposal programs. It may even be possible to utilize pre-existing grant infrastructures for leverage.

Once the structure and process has been researched, established, and initially implemented, the mid- to long-term goal will be to show through clear metrics the way in which funded proposals have significantly enhanced the public's engagement with Mars.

Beyond the above program, one issue to be addressed in particular is whether and how to handle very small grants, as the overhead of processing them can sometimes be too exorbitant for cost-effective programming. At the same time, they provide opportunities for individuals to contribute to public engagement in meaningful ways (e.g., a talented speaker who needs to rent visualization equipment for community presentations or a master teacher who needs travel funds for conducting workshops in his or her local region or state). It might be possible to supply the Space Science Broker/Facilitators in the Support Network with funds for this purpose.

Proposals will provide innovative ways to promote this plan's vision of Sharing the Adventure and Making Mars a Real Place. Proposals have the potential to serve all goals and objectives. This Activity primarily serves Goal 5 (Infusion of New Ideas) through Objective 2 (Strong Networks) and Objective 4 (Easy, Assured Access). It will also assist in meeting Goal 2 (Diversity and Educational Equity) through the same Objectives. See also Appendix E.

This activity supports NASA Strategic Goals 6 and 7 and NASA Office of Education Operating Principle A (Customer Focus) and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP ACTIVITY B: PROPOSAL SOLICITATIONS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Conduct research that leads to the design of a well-thought-out program for proposal solicitations.	Begin implementation and show impact of proposal solicitation program in extending Mars Public Engagement.	

ACTIVITY C: PRINCIPAL INVESTIGATOR PARTICIPATION

Science instrument proposals for Mars missions include a section on education and public outreach. This proposal section enables science teams whose instruments are selected to participate in public engagement. Typically, these education and public outreach proposals are 1-2% of the instrument costs.

In developing and implementing their proposed public engagement activities, Principal Investigators are encouraged to coordinate their Education and Public Outreach efforts with the broader goals and objectives outlined in this plan and to take advantage of pre-

existing infrastructures for cost-sharing and cost–saving. They are welcome partners in already established programs, and are vital to the generation of new activities.

This flexibility maximizes both creativity and the leverage of "well-oiled" public engagement programs with wide, pre-existing participant bases. Those who choose to engage in on-going activities give those programs vibrancy and new life. Such participation diminishes the need to "reinvent the wheel" and allows enthusiastic public participants (teachers, students, etc.) to build their knowledge as each new mission comes into the public engagement program. Those who also propose new activities will infuse the public engagement program with innovation and allow them to make direct and deeper connections with the communities in which they reside.

As previously mentioned, the Mars Public Engagement staff will work closely with the science teams (through Project Science Group meetings and other relationship-building activities) and will actively solicit feedback to determine the best ways the public engagement program can provide commonly needed support.

Principal Investigator participation will help meet the vision in this plan by serving all goals and objectives. See appendix E for details. This activity serves NASA Strategic Goal 6 and 7 and NASA Office of Education Operating Principles, especially B (Content) and potentially F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP ACTIVITY C: PRINCIPAL INVESTIGATOR PARTICIPATION		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Form good working relationships with Principal Investigators and science teams to extend reach of national program and establish means to incorporate their ideas into planning and implementation.	Work with Principal Investigators and science teams in creating Public Engagement Payloads.	

3.2.3 Crosscutting Thread 3: Visualizations

ACTIVITY A: VISUALIZATIONS & VISUALIZATION ACCESS INFRASTRUCTURE

Mars Public Engagement will continue to fund visualizations that make Mars and Mars exploration an exciting experience. Since dissemination is just as important as having the actual imagery, Mars Public Engagement will develop special networks/channels (e.g., servers with dedicated bandwidth) so that special groups such as informal education institutions can have uninterrupted access for the latest images and visualizations. Such a channel will enable these organizations to download or downlink without running into conflicts with the numbers of people wanting access. Early announcements of upcoming events (and science discoveries) will better enable these institutions to have time to interpret results and plan public events around data returns.

This Activity will help meet the vision of Sharing the Adventure and Making Mars a Real Place perhaps more than any other activity in this plan. It has the potential to serve all goals and objectives, especially Goal 1 (Communicate the Story) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy, Assured Access), and Objective 7 (Real-time Data and Information and Real-time Expert Interactions). See Appendix E.

It serves NASA Strategic Goal 6 (6.1.1-4, 6.1.2, 6.2.1, 6.2.3-4, 6.3.1-4, 6.4.1-3) and 7 (7.1.1-2) and NASA Office of Education Operating Principles, especially B (Content). See Appendices I and J.

ROADMAP Activity A: VISUALIZATIONS & VISUALIZATION ACCESS INFRASTRUCTURE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Continue to fund the creation of multi-purpose, experiential imagery and invest in infrastructures that allow their timely, quick, easy, and uninterrupted delivery.	Provide increasing levels of "virtual Mars" experiences during Scout, Mars Science Laboratory, and other missions.	

3.2.4 Crosscutting Thread 4 : Speaker Support

ACTIVITY A: TRAVEL AND MATERIALS SUPPORT

On a scaleable basis depending on funding availability, Mars Public Engagement will support travel by scientists and engineers to high-leverage education and public outreach events. It will also support the creation of speaker kits that contain the very latest images (and supporting information written in public-friendly, scientifically accurate form) in VHS, slide, and Power Point formats. The latter in particular will also be disseminated widely to speaker networks such as the Solar System Ambassadors. This effort will enable the program to reach into communities nationwide with continuously updated materials that take advantage of mission events. In the long-term, linking Mars scientists and engineers who express a desire to deliver public talks with local museums, Solar System Ambassadors, educators, and regional NASA broker/Facilitators will create a localized base of speakers. Mars Public Engagement staff will actively work with speakers to support them in the resources and infrastructures that they identify as needs and improvements.

Sending speakers to high-leverage venues supports the vision of Sharing the Adventure, as this activity allows one-on-one human interactions that give people a chance to interact directly with Mars experts. The visual materials they carry with them will help Make Mars a Real Place in people's consciousness, particularly with slide shows and other large formats. Identifying speakers from diverse backgrounds who can also serve as role models for underrepresented demographics in the NASA workforce will also be a priority.

This Activity meets the following goals: Goal 1 (Communicate the Story), Goal 2 (Diversity & Educational Equity) by taking the story to various venues nationwide, Goal 3 (Communicate Mission Safety) through prepared materials, Goal 4 (Direct Public Involvement) through activities and one-on-one interactions, and Goal 5 (Infusion of New Ideas) as speakers hear from the public and bring back ideas for more or different presentation materials. Speakers also meet the above goals through Objective One (Visualizations and Virtual Experiences) in presentations, Objective 2 (working through Strong Networks), Objective 3 (bringing Science through the Arts in storytelling and imagery), and Objective 5 (Real-time or near-real-time Data and Expert Interactions). See also Appendix E.

This activity additionally supports NASA Strategic Goal 6 (6.1.1-3, 6.2.3, 6.3.1-2, 6.3.4, and Goal 7 (7.1.2-3), as well as NASA Office of Education Operating Principles A (Customer Focus), B (Content), and D (Diversity). See Appendices I and J.

ROADMAP Activity A: TRAVEL AND MATERIALS SUPPORT		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Provide updated visuals and "speaker kits" and actively seek feedback from science and engineering speakers to deliver needed and requested support.	Have in place an identifiable and expanding base of Mars speakers in communities around the country, and an easy means for organizations to identify possible speakers and long-term relationships with them.	

3.3 INTRODUCTION TO FORMAL EDUCATION ACTIVITIES

Education is at the heart of what makes this nation great. It is the foundation for widespread economic prosperity and personal well-being. At its best, education motivates self-esteem, the capacity to work with others, and confidence in the ability to achieve one's aspirations through personal dedication, teamwork, increased knowledge, critical thinking skills, and expanded learning opportunities. All of these qualities are requisite to the kind of flexible and skillful workforce that NASA and other businesses are seeking now and in the future. If, as a nation, we wish to remain a leader long into the 21st century, we must inspire a new generation of scientists and engineers, as well as contribute to an informed and literate citizenry.

Mars exploration offers a unique "hook" for inspiring an interest in learning, as it offers real-world (but out-of-this-world!) examples of how science and math are relevant and applied in the world. While school children may once have felt removed from these applications, believing space exploration to be for "rocket scientists" and far beyond their reach, Mars exploration now offers direct chances for students to participate in the analysis of real Mars science data; in building robots of their own; and, in using software tools that mimic those used by Mars engineers. It is no longer only about students learning answers from books and lessons, but also about having the opportunity to discover and provide the answers themselves. It is about making connections to discovery and to the people who currently have careers in all fields that make space exploration possible. The Mars community has a number of opportunities to connect: through classroom visits, educational programming on television and through the web, the review of educational materials for accuracy, and much more. They are inspiring role models for future generations. For today's space explorers, such connections with students can provide satisfying answers to the question: "Who will follow in our footsteps, and where will they take us next?" For children, it inspires the thought: "I could be the one."

In that regard, educational equity is one of NASA's highest priorities. To make a meaningful difference, Mars formal education activities must be open to all children and not just top performers. Encouraging skill, racial, ethnic, and gender diversity in science and engineering education is also crucial if we are to take advantage of our national potential.

The best way of reaching children is reaching teachers. Educators represent more than 3 million people in our nation's workforce, and reach 53 million children in classrooms each day. Our highest priority will be to work for the benefit of teachers (pre-service and in-service) and in partnership with the organizations that support them—school districts, community colleges (especially for pre-service instruction), educational organizations, and local, state, and national education departments. Overall, the long-term goal is to build a set of easy-to-access, easy-to-use, easy-to-evaluate programs that allow low-, mid-, and hi-tech learning opportunities with strong, built-in supports for teachers. All activities will be tied to national standards in education, and materials will be provided in

a variety of formats (print, CD-Rom, online, and broadcast) for equitable and wide dissemination.

3.4 PLANNED FORMAL EDUCATION ACTIVITIES

Key Formal Education activities are organized by focus areas, or "threads." Following a brief description, a "mini-roadmap" is provided for each activity (extracted from the overall roadmap in Appendix D for easy referencing).

3.4.1 Formal Education Thread 1: Student Imaging and Analysis

ACTIVITY A: MARS STUDENT IMAGING PROJECT

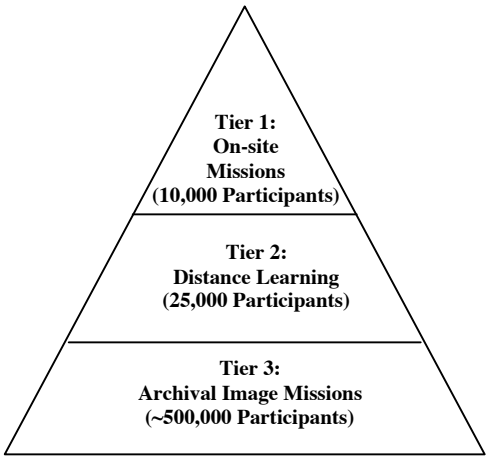
The Mars Student Imaging Project at Arizona State University (ASU) will utilize a NASA imaging facility that will be used by scientists and students studying Mars. It will be available to grade 5-12 and undergraduate educators and students (including groups from formal and informal education settings) and will allow different levels of participation (see tiered diagram, next page).

At the most expansive level, teacher guides and curriculum supplements will be created (with educator participation at all stages) using real data at first from Mars Global Surveyor and later from 2001 Mars Odyssey, Mars Reconnaissance Orbiter, and other future missions. These activities will be beta-tested, reviewed by both scientists and master educators, and made available on-line and in hard copy where necessary. All are inquiry-based classroom activities that meet the National Science, Mathematics, and Technology Education Standards. They will be made widely available online, through educator workshops nationwide, and to all teachers who would like to participate in the project. Pre- and post-project mentoring for teachers by the Mars Student Imaging Project educational staff will be part of the program design, maximizing the impact of real-science infusion into the classroom.

Through this program, a number of middle-school, high-school, and undergraduate students will also have the opportunity to participate directly in the scientific exploration of Mars in near real time. In the near-term, a percentage of the pictures taken by the THEMIS instrument on the Odyssey spacecraft will be dedicated for student use (with program expansion possible with future missions, including Mars Reconnaissance Orbiter and beyond). Student teams from across the U.S. will submit proposals to take pictures of specific regions of Mars, explaining the scientific questions they would like to answer with the data. They will then have the opportunity to participate in acquiring the image, analyze the data they receive, and present their findings. Approximately 150 classes per year (both on-site visits by teams to ASU and teams using distance-learning technologies) will be able to participate, with at least one school from every state participating. It is projected that the number of participating teams will increase by at least 10% each subsequent year. At least one quarter of the imaging team slots will be reserved for under-represented groups (minority, female, rural, and inner-city), which

will be recruited through contacts with minority institutions (HBCUs, HSIs, etc.) and other programs.

In addition to on-site student missions, more opportunities for students will be enabled through distance-learning opportunities. For even wider participation, those whose proposals are not selected will have special, tailored opportunities through the use of a special archived image library.



Tiered Approach to Participation
In the Mars Student Imaging Project

A special advisory group focused on minority and under-represented education issues will also be formed to ensure that educational materials from this program will have the widest use. One near-term way of expanding the reach of the program is to link it to such pre-existing, privately funded programs such as the "Skymobile Project" run by the LA County Museum of Natural History. This project reaches students of various ethnic and income backgrounds in the Los Angeles Unified School District each year. Participating teachers who wish to pursue their interest will be linked to the Mars Student Imaging Project, given the guided learning experience on Skymobile neatly dovetails with the content and goals of the Mars Student Imaging Project. This approach could be repeated with Challenger Learning Centers and other formal and informal education organizations conducting Mars-related programming.

Having students analyze real Mars data can be quite exciting. The Mars Student Imaging Project in the near-term will enable Mars Public Engagement to gain significant expertise in creating access to data and helping students and teachers navigate their way through it to Mars' geographical sites and topics of interest. In the long-term, the wealth of large Mars data sets available (from Viking onward) can provide rewarding work for students, and maybe even contribute to real scientific discoveries by these students. An analysis of how to make data sets available to students and teachers in a way that facilitates their engagement will be undertaken, with recommendations for future projects determined thereafter.

National Science Education Standards frequently (but not exclusively) used in this program are those falling under Science Content Standards Category 1 (Unifying Concepts and Processes), Category 2 (Science Inquiry), Category 3 (Physical Sciences), and Category 5 (Earth Sciences). See Appendix F.

The Mars Student Imaging Project meets the vision of Sharing the Adventure, giving students direct opportunities to participate. With real Mars images to use for discovery and exploration, Mars can increasingly and vividly become a Real Place. This activity has the potential to serve Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), Goal 4 (Direct Public Involvement), and Goal 5 (Infusion of New Ideas) as feedback from participants comes in. The above goals are also met through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) of participating students and teachers, Objective 4 (Assured, Easy Access) through the tiered approach to participation, and Objective 5 (Real-time Data and Information and Real-time Expert Interactions) as students receive the data and interface with participating scientists. See also Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-2, 6.1.4, 6.2.3, 6.3.1-2, 6.4.1, and 6.4.3). It applies to all NASA Office of Education Operating Principles (A-F). See Appendices I and J.

ROADMAP Activity A: MARS STUDENT IMAGING PROJECT		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Gain experience and build teacher base through Mars Student Imaging Program.	Make large Mars data sets (from Viking onward) widely accessible to classrooms in easy-to-use form.	

ACTIVITY B : STUDENT IMAGING & ANALYSIS INTERNS

This section was originally under Robotics Education, but during the FY02 – FY04 period, the Athena Student Intern program turned out to be much more experiential in imaging and analysis rather than in robotics (although exposure to the telerobotic operation of rovers was included). A Robotics Student Intern Program is still planned, however, under section 3.4.2.

The foundation for this program grows out of a pilot effort developed by Cornell and Washington University called LAPIS (originally part of the E/PO plan of a science instrument proposal for the cancelled 2001 Mars lander). Over a three-year period, LAPIS actively involved small groups of high-school teachers and students in working with science mentors and engineers during annual rover field trials. Using software that mimics real Mars rover mission operations (including ground operation system on Earth, communication between Earth and Mars, and surface operations on Mars), students identified rock targets, directed the rover to them, and conducted measurements. In the future, the intent is to broaden the base of participation through a tiered structure of

participation. Future classes of student interns (named after missions or instruments selected on future missions if PIs propose to extend the reach of this activity) are also possible, depending on interest from selected Principal Investigators.

In the near-term, "Athena Student Interns," named originally for the instrument package on the Mars Exploration Rovers, will continue to provide close, one-on-one interactions between students, teachers, and scientists. For feasibility, about fifteen high-school classes located in the geographic area of science team members will have special roles. Student leaders from each of these groups will be selected to participate on site, not only on the basis of their knowledge and leadership qualities, but also on their public-speaking abilities (for media and web communications). They will come to JPL during the field trials and selected portions of the landed mission and will interact with their classmates back at home and with other students around the country who will all be able to interact with them through the Internet and other distance-learning techniques. In the mid- to long-term, Mars Reconnaissance Orbiter, Phoenix, and Mars Science Laboratory will have student-intern programs as well.

This Activity meets the vision of Sharing the Excitement and Making Mars a Real Place by essentially bringing Mars to student desktops and classrooms. Because it is interactive and allows students to choose directions and experiences, it gives them the potential to be virtual explorers. The Mars Robotics Education Partnership supports Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 4 (Direct Public Involvement) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy and Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

It supports NASA Strategic Goal 6 (6.1.1, 6.2.1, 6.2.4, 6.3.1, 6.4.2, 6.4.3) and all NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity A: MARS STUDENT IMAGING & ANALYSIS INTERN PROGRAM		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Gain experience in initial student intern program and form "virtual" student analysis teams (connected through e-learning) for wider reach.	Sponsor intern opportunities with future mission teams and make large Mars data sets available for expanded experiences for increasing numbers of users.	

3.4.2 Formal Education Thread 2: Robotics Education

The Robotics Education thread has one of the greatest potentials to make an impact on the nation's youth by providing them with direct experience with technology, engineering, mathematics and science. The activities in this section will provide students with opportunities to develop the skills and interest needed for the high-technology jobs of the future. Robotics education activities will build in content standards for technology education as developed by the International Technology

Education Association and its Technology for All Americans Project. Robotics education is essentially a subset of "technology education," which ITEA defines as "problem-based learning utilizing math, science and technology principles." Therefore, the following activities will, along with technology standards, also build in national science and mathematics standards to the greatest extent possible.

The great and unique advantage offered by Mars Exploration and associated robotics education activities is that students have access to an exciting and inspiring example of how the skills and knowledge they are learning can be applied to real-world jobs. Some students will likely become NASA engineers of the future. Others will be better prepared to work in a world where critical thinking, problem-solving, teamwork, and engineering design skills are paramount. All who participate will have exposure to, and knowledge of, the important role that technology plays in society and in economic well-being. They will be able to understand how human ingenuity carries us to the planets and toward other far-reaching discoveries that produce new knowledge and inventions that can have important benefits in health, transportation, energy, manufacturing and materials processing, communications, and other fields here on Earth.

All robotics education activities in this plan support the basic components of technological studies as defined by the International Technology Education Association:

- Designing, developing, and utilizing technological systems;
- Open-ended, problem-based design activities;
- Cognitive, manipulative, and affective learning strategies;
- Applying technological knowledge and processes to real world experiences using up-to-date resources; and,
- Working individually as well as in a team to solve problems

ACTIVITY A: MARS ROBOTICS EDUCATION PARTNERSHIP

This program will use robotics as a means to enable a sense of participation in Mars exploration. Three avenues will be pursued:

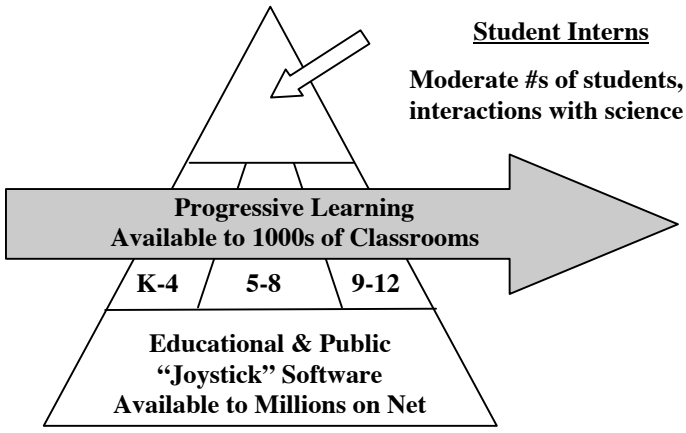
- First, the goal is to build a cohesive set of robotics activities at all grade levels, so that students will increasingly be prepared to take advantage of the program. Progressive learning might occur in the following way: grade-school children would have small robots built from kits that they can learn to maneuver in simulated martian terrain (made from common classroom materials) or classroom "hazards" (e.g., piles of books). This format, developed through workshops with teachers from the RoboEducators group and including colleagues from other NASA Centers, would allow teachers to introduce important science and math concepts such as remote sensing, geology, and measurement. Middle-school students could potentially use

3-D Environment software with photorealistic terrain models constructed from both archived and real-time mission data in combination with standards-aligned curricula to provide students with an immersive learning experience (stand-alone modules or longer term). High-school efforts could involve real-time and simulated rover tests on Earth (using real data), and possibly even surface operations at Mars. Computer models of rovers could be deployed on virtual environment terrain models, allowing students to learn science, math, and technology concepts through the experience of controlling their own rover missions. High-school students could also work with simplified versions of mission software. Activities at each of these levels would be tied to grade-appropriate standards for science, technology, and mathematics.

- Second, a robotics internship program will also be created for direct mission experiences, in coordination with NASA's Robotics Education Program. Students may be drawn from programs like FIRST Robotics or from undergraduate and graduate programs. The goal will be to provide authentic experiences in engineering that prepare students for potential careers in robotics. Participants will be tracked to assess entry into engineering or technical studies and careers.

- Third, investments will be made in modifying robotics-related software so it is much more public-friendly and easy to use. The goal is to have software available for educational and public use over the Internet. People could download software and get real (and almost real-time) data of martian terrains. Visualizations (descent views, overhead view, panorama view, wedge view, 3D view of terrain, and more) would enable people to follow along as rovers move around Mars and to analyze what they did on the surface that day. Software could enable multiple users to collaborate--two classrooms in different cities could view the same images, select targets, generate a sequence collaboratively to move the rover to its destination, and study the results.

The Mars Robotics Education Program takes a tiered approach to participation. At the top of the pyramid are in-depth opportunities for a select number of students to interact with science team members in their home areas. Progressive learning opportunities will be created at each grade level to reach more students, and an easy entry point to more advanced programming will be provided through educational and public software that make it easy for participants to move a virtual rover over the surface of Mars.



TIERED APPROACH FOR MARS ROBOTICS EDUCATION PROGRAM

National Science Education Standards most applicable to this program include, but are not limited to: Category 1 (Unifying Concepts and Processes), Category 2 (Science Inquiry), Category 3 (Physical Sciences), Category 5 (Earth Sciences), and Category 6 (Science and Technology). See Appendix F.

This Activity meets the vision of Sharing the Excitement and Making Mars a Real Place by essentially bringing Mars to student desktops and classrooms. Because it is interactive and allows students to choose directions and experiences, it gives them the potential to be virtual explorers. The Mars Robotics Education Partnership supports Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 4 (Direct Public Involvement) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy and Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

This Activity additionally supports NASA Strategic Goal 6 (6.1.1-2, 6.1.4, 6.2.1, 6.2.3, 6.3.1-2, 6.4.1-3) and all NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity A: MARS ROBOTICS EDUCATION PARTNERSHIP		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Gain experience through Mars Robotics Education Partnership by developing progressive learning opportunities and the internet capability for the public to "joystick" around Mars with virtual rovers.	Make large Mars data sets from the Smart Rover and other missions available in real-time for expanded robotics education experiences for increasing numbers of users.	

ACTIVITY B. FIRST ROBOTICS

FIRST Robotics is a highly regarded national engineering contest that immerses high-school students in engineering. Teaming up with engineers from NASA, businesses, and universities, students get a hands-on, inside look at the engineering profession. In six intense weeks annually, students and engineers work together to brainstorm, design, construct, and test their champion robots. The teams then compete in a spirited, no-holds-barred tournament complete with referees, cheerleaders, and time clocks. The result is a fun, exciting, and stimulating environment in which all participants discover the important connection between classroom lessons and real-world applications. A high percentage of the students are from urban and under-represented environments. It also gives Mars engineers a chance to work with schools in their area of expertise and to serve as role models for the students they work with. Enthusiasm from engineering participants is high, and most are eager to repeat the experience in coming years.

While more engineering-focused in nature, science goals can be served as participating team members can disseminate Mars science materials and information that will help

students see the kinds of discoveries and careers in space-exploration that are possible for them.

Supplemental educational materials on Mars would be tied to National Science Education Standards in at least the following science content categories: Category 1 (Unifying Concepts and Processes), Category 2 (Science as Inquiry), Category 6 (Science and Technology).

This Activity meets the vision of Sharing the Excitement as engineers interface with students and communicate their own experiences, and has the potential to make Mars a Real Place as mentors increasingly are provided with images and other materials to supplement their ongoing interactions with the student teams. This activity helps meet Goal 1 (Communicate the Story), Goal 3 (Communicate Mission Safety) as students try and fail, before succeeding in their learning, and Goal 4 (Direct Public Involvement). These Goals are primarily met through Objective 6 (Real-time Data and Information and Real-time Expert Interactions). See also Appendix E.

It additionally supports NASA Strategic Goal 6 (6.1.1 and 6.3.1) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: FIRST ROBOTICS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Build on engineer involvement with under-served students through FIRST Robotics and build Mars content into mentoring discussions.	Work with national FIRST organization to create and insert Mars content into an aspect of the nationwide program.	

ACTIVITY C. "SURVIVOR" ROBOTICS COMPETITION

In addition to communicating NASA's serious focus on safety, the Mars Public Engagement team also has an opportunity to highlight how the agency is engaged in a daring endeavor. It is the willingness to assume (acceptable) levels of risk that in fact allows the achievement of great feats. By sharing the challenges, the attempt will mean more when we do succeed. Exploring Mars is a great adventure, and adventure by definition entails reward and risk. The public should be informed of both. More than that, there might even be innovative opportunities for the public to participate in experiencing risk and reward themselves.

To provide an innovative example, the Mars Public Engagement program could sponsor a competition in which individuals and companies design and build their own (small, lightweight) rovers. In partnership with the Air Force or an airline, these small rovers could be dropped from a plane over undisclosed Mars-like terrain here on Earth. It would be the ultimate Survivor show—a robotic adventure open to all. Some robots would

make it, others wouldn't. Those that did could go on to pursue a pre-established target. Media coverage would be huge and regional-- inevitably some small-town "built-in-the-garage" efforts would do well, some high-tech corporate robots would suffer, and a whole lot of possibilities in between. The risks and challenges would be real, and the process would come alive in a personal way.

While anyone could participate as a life-long-learning kind of activity, a formal education component would be developed. Given experiences with Mars Robotics Education Partnership and FIRST Robotics in the near-term, high-school-level and university-level classroom materials could be prepared for students interested in taking on a team project. Links to existing programs between NASA and universities (e.g., the emerging program called "Planetary Bootcamp," in which engineering students learn to conduct a mission during coursework at their universities and then come to JPL to run a simulated mission) might be formed so that student engineering teams from participating colleges and universities would receive credit for their coursework. In addition to learning, it could spark a whole new kind of intercollegiate rivalry as the teams competed against one another. Such an opportunity would also highlight future career opportunities at NASA for participating engineering students.

National Science Education Standards potentially served include: Category 1 (Unifying Concepts and Processes), Category 2 (Science Inquiry), Category 3 (Physical Science), Category 5 (Earth Science), and Category 6 (Science and Technology). The Activity could also contribute to Mathematics and Technology standards as well.

The Survivor Robot Competition meets the vision of Sharing the Excitement as students (or other members of the public) experience for themselves just how much goes into a mission. With an Earth analogue site selected for landing, the Activity creates a direct experience of "Mars on Earth," thus Making Mars a Real Place, if by proxy. To extend the sense of Mars as a real place, connective work would be done to feature images of the martian surface in geographical areas similar to the Earth landing site, to make the red planet more recognizable. This Activity has the potential to serve Goal 1 (Communicate the Story), Goal 3 (Communicate Mission Safety), Goal 4 (Direct Public Involvement), and Goal 5 (Infusion of New Ideas) from external partners. A primary objective served is Objective 5 (Public Engagement Payloads), at first here on Earth, but potentially could one day become a program that could generate Public Engagement Payloads to Mars as well. See also Appendix E.

This activity will require much research, planning, and development work, so is slated as a mid-term or long-term activity.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.1, 6.2.3-4, 6.3.1-4, 6.4.1-2) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability. See Appendices I and J.

ROADMAP Activity C: "SURVIVOR" ROBOTIC COMPETITION		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Research and planning (inc. research on ground-based sites, operation of rovers through communications satellites and GPS, contacts with potential Air Force or commercial airline partners, and small grant opportunity for concept studies).	With an experienced cadre of students and teachers who have participated in near-term robotics education programming (Mars Robotics Education Partnership, FIRST), sponsor a "Survivor style" rover competition here on Earth.	

3.4.3 Formal Education Thread 3: Arts, Letters, & Humanities

ACTIVITY A: IMAGINE MARS

"Imagine Mars" is a national science, art, and technology education initiative challenging students to design a community on Mars that would be scientifically sound and offer a high quality of life. It draws on the former Mars Millennium Program. NASA has already invested significantly in curriculum development and inter-agency partners remain interested in co-funding this program. Teachers continue to ask about renewing the program, and an infrastructure already exists that will allow Mars Public Engagement to gain experience in integrating science with arts and humanities curricula. A relaunch of the program under a new name will allow the best elements of the former program to be preserved, while distinguishing it as a new opportunity.

Such an integration of science, mathematics, and technology with the arts and humanities can open a door into science and technology for students who are more humanities-inclined and would otherwise not be as exposed to the excitement of scientific discovery. It can also tie into other proposed outreach activities such as the Environmental Initiative(see Section 3.8.3) in illuminating Earth/Mars comparisons and how to make wise and balanced decisions about our own planet. The focus will be on encouraging critical thinking skills, however, rather than any specific agenda or message. The strength of the program, is in fact, that individual classrooms can arrive at their own answers and compare them with those of other students nationwide.

In the near-term, Imagine Mars will leverage NASA's previous investment. The National Endowment for the Arts has already agreed to partner, with shared funding, in the revival of this program. Re-engaging the 150+ original partners will be one of the first goals. In the long-term, making solid connections with these partners will be important to defining new programs and relationships that could integrate the sciences and the arts effectively in the future.

The Imagine Mars experience has a unique potential to contribute to serving Category 7 (Science in Personal and Social Experiences) of science content standards in the National Science Education Standards. All of the other Categories can also be served, particularly

Category 1 (Unifying Concepts and Processes) and Category 5 (Science and Technology). See Appendix F for more details.

This program supports the vision of Sharing the Adventure by giving students the ability to design their own "home base" on Mars, using knowledge gained about Mars, civics, architecture, and other disciplines. It gives students who aren't necessarily immediately attracted to science and technology an entry point into further learning. It also supports the vision of Making Mars a Real Place as students imagine where on Mars they'd like to establish the community of their imagination. Goals served include Goal 1 (Communicate the Story) and Goal 2 (Diversity and Educational Equity), particularly as paths are opened for students who haven't been exposed to science and technology. These Goals are furthered through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks), Objective 3 (Science through the Arts), and Objective 4 (Easy, Assured Access). See also Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-2) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: Imagine Mars		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Leverage the previous NASA investment and new funds from interagency partners to recreate an arts & sciences program called Imagine Mars (formerly Mars Millennium)	Build on the experience gained through "Imagine Mars" to introduce science and math through working with a network of art museums and other interested organizations.	

ACTIVITY B: MARS EXPLORATION LITERACY INITIATIVE

This initiative will disseminate Mars science through reading activities. An expanded focus on Mars-related, reading and writing curriculum support materials will be developed, and new networks of contacts will be developed among language arts specialists. Special activities could also bring in the best of science fiction, with an analysis of what is science and what is fiction. As an informal education extension of standards-based reading curricula, Mars Public Engagement will also seek to partner with school and children's librarians (potentially through such partners as the American Libraries Association) to reinforce what was learned and to offer children with opportunities for further reading. In addition to reviewing and maintaining book lists on Mars, Mars Public Engagement could also sponsor writing contests, with potential prize participation in mission events or other special rewards that teachers could use as incentives. The writing assignments would be designed to correlate closely with content (grammar etc.) teachers are expected to convey to their students.

This initiative could further any of the science content standards, and also contribute to reading and writing educational standards as well. This initiative has the potential to

further the vision and all goals and objectives in this plan. It particularly serves Goal 1 (Communicate the Story) and Goal 2 (Diversity and Educational Equity) given its potential to reach many students. These goals are primarily served through Objective 3 (Science through Arts, Letters, and Humanities). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability. See Appendices I and J.

ROADMAP Activity C: MARS EXPLORATION LITERACY INITIATIVE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Research and plan opportunities for beginning a literacy program.	Create a Mars Exploration Literacy Initiative.	

3.4.4 Formal Education Thread 4: Educator Workshops

ACTIVITY A: NATIONWIDE WORKSHOPS

Each year, the Mars Public Engagement program will support educator workshops around the country, including those at regional and national educator conferences. These workshops are hands-on, inquiry-based opportunities for educators to learn about science, technology, mathematics, geology, and other subjects related to Mars, as well as to strengthen their instructional capabilities. Curriculum support materials for use in these workshops will also be produced. Mars Public Engagement will also take into account widespread teacher requests for printed classroom materials, but will also make everything available on-line. As technology makes it feasible and desirable over the next decade, investments will be made in distance-learning and distributed-learning environments. Workshops also enable teachers to learn of NASA and Mars Public Engagement programs and resources available to them. Workshops through distance learning are already in progress, and will continue to improve and expand with input from the user community and through independent evaluations. In cooperation with minority universities, the ability to hold workshops for pre-service teachers will also be pursued.

In the near-term, funding will be provided for Solar System Educators, a program jointly funded by Mars Public Engagement and other solar system missions. It competitively selects and then trains master teachers in space-science educational materials and methods. Each master teacher is required to train another 90 to 150 teachers, resulting in a leveraging effect of about ten thousand teachers directly trained each year. While in principle a good idea, continued funding will depend on evaluations of the program's effect. In the meantime, Mars Public Engagement will specifically work to disseminate a strong (evaluated) set of Mars-related activities that form a core teaching product. In

addition, Solar System Educators will be increasingly linked to major on-going activities such as the Mars Student Imaging Project, the Mars Rover Exploration Partnership, FIRST Robotics, and Imagine Mars. Mars Public Engagement will also take a more active role in connecting the Solar System Educators to museums and other community organizations in their local areas for joint educational events.

Workshops can further any of the science content standards, as well as mathematics, technology, and other standards.

Workshops have the potential to further the vision and all goals and objectives outlined in this plan, but particularly help serve Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 3 (Communicate Mission Safety) through any risk communications materials made available. These Goals are primarily served through Objective 2 (Strong Networks) that can be built with participating educators, Objective 4 (Easy, Assured Access) given nationwide and distance-learning opportunities, and Objective 6 (Real-time Data and Information and Real-time Expert Interactions). See also Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.2, 6.1.4, 6.2.3, 6.3.1-2, 6.4.1-3) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: NATIONWIDE WORKSHOPS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Continue to build on current workshops and begin working with minority and other colleges and universities to develop workshops for pre-service teachers.	Demonstrate that workshops serve as a "feeder" into other ongoing Mars educational programs to create personalized, long-term relationships with interested teachers and establish a strong program with minority and other universities based on their input.	

ACTIVITY B: MARS EDUCATION EXTENSION CENTERS AT INFORMAL EDUCATION ORGANIZATIONS

This initiative will seek to partner with informal education organizations that conduct educator workshops. The goal will be to set up "extension centers" in cooperation with regional museums, science centers, planetaria, and related organizations that create programs for assisting teachers in accessing and using images and visualizations in their classrooms. Mars distance-learning opportunities and programs such as the Student Imaging Project and the Mars Rover Exploration Project could also be highlighted in these interactions. Because museums have widely diverse education programs, great effort would be made in the definition phase to work in partnership with formal and informal educators in designing this program. Challenger Centers located nationwide with Mars programming might be ideal partners, so opportunities to work with and through them will be pursued.

Workshops at education extension centers can further any of the science content standards, as well as mathematics, technology, and other standards. Workshops have the potential to further the vision and all goals and objectives in this plan, but particularly help serve Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 3 (Communicate Mission Safety) through any risk communications materials made available. These Goals are primarily served through Objective 2 (Strong Networks) that can be built with participating educators and museums, Objective 4 (Easy, Assured Access) given nationwide and distance-learning opportunities, and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.4.2-3) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F(Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity B: MARS EDUCATION EXTENSION CENTERS AT INFORMAL EDUCATION ORGANIZATIONS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Begin making connections with museums that hold educational workshops, assess interest, and gather input.	Partner with informal education organizations to create "extension centers" for holding educator workshops frequently nationwide.	

ACTIVITY C: PARTNERSHIPS WITH STATE EDUCATION DEPARTMENTS

In order to ensure a coordinated approach, all partnerships with state education departments will be worked in coordination with established channels at NASA HQ and not pursued independently.

Initial discussions are underway to develop a program in which Mars Public Engagement can contribute to systemic reform. The State of California has expressed an interest in how NASA can contribute to developing interdisciplinary math and art programs related to Mars content. One reason for this expressed wish is the importance of mathematics, the decline among many schools for arts funding, and the opportunity to make both subjects more interesting to students. Also discussed has been the possibility of developing a Mars-based unit for instructing California's "emergency credential" teachers, who typically have no background in science, mathematics, or technology. The subject of Mars is appealing because it is easy to understand in relation to Earth examples, provides an inspiring "destination," and can address various scientific disciplines (chemistry, geology, biology, physics) in a comprehensive, integrative, introductory way. Working with the State of California has national meaning, as a large number of students from all over the country who wish to become teachers receive training through the California State University system.

While near-term contacts with California will be pursued, early research will be done to assess opportunities with other state education departments. Since the State of Pennsylvania is already incorporating Mars content into its classrooms (see Mars Robotics Education Partnership), this existing program may be an early partnership to pursue. Given that Mars missions over the next decade will all launch from Florida, that State might have interest as well. In the long-term, a pilot program with one of the State Education Departments will be pursued, with one of two goals in mind: integrating Mars-related content into state frameworks for education so that they enter the classroom, or having Mars-related content be part of a (pre- or in-service) statewide teacher training program.

This partnership has the potential to affect any of the National Science Education Standards, not only in the area of science content, but also in the area of "science teaching standards" (Chapter 3 of the National Science Education Standards) and in the area of "standards for the professional development of teachers of science" (Chapter 4 of the National Science Education Standards).

This kind of a partnership also has the potential to further the vision and all goals and objectives in this plan. Especially important is Goal 2 (Diversity and Educational Equity) through Objective 1 (Strong Networks), Objective 4 (Easy, Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions). See also Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles: A (Customer Focus), B (Content), C (Pipeline), D (Diversity), E (Evaluation), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity C: PARTNERSHIP WITH STATE EDUCATION DEPARTMENTS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Create a partnership with the CA State Government and assess Opportunities with other states.	Pilot program with CA or other State Government Education Departments, with a goal of integrating Mars-related content into state frameworks for education or into statewide teacher training programs.	

3.5 INTRODUCTION TO INFORMAL EDUCATION ACTIVITIES

Informal education covers all of the enriching experiences found in museums, science centers, planetaria, libraries, parks, youth groups, and community organizations. These organizations all provide places where people can gather for shared experiences and life-long learning. What they have in common is the ability to connect people to something larger than themselves—whether an idea, an environment, an image, or a fellowship group. Most of all, they have the power and the expertise to create lasting memories and experiences for people. By partnering with them on projects of mutual benefit, we can reach and inspire larger and more diverse audiences, while finding rewarding opportunities to share communications expertise.

Recognizing that planning horizons for many of these organizations can be long (typically 3-5 years, with fewer 3-6 month projects), it is imperative to begin looking for ways to build relationships without the expectation of immediate results. Near-term opportunities can find champions, but it's important to work with the informal education community up-front and long before the event horizon. Very short-term events centered on key mission moments are possible, so long as they are well advertised. Advance notice of available products (visualizations, possible speakers etc.) is particularly helpful to the informal education community. These organizations are agents in their own communities, and can share the experience as it happens, so long as they have sufficient opportunity to prepare.

Priorities for the informal education community include:

- access to Mars experts;
- curator training opportunities;
- a system for regularly distributing visualizations, images, and science content to museum and other networks;
- affordable, small-scale exhibits; and,
- fun, meaningful, hands-on projects geared for after-school, family, and community groups.

Getting stunning images and visualizations into the hands of informal educators is a high priority. Timing is everything, and they have to be ready to "get it when it's hot." Public expectations are high, so it is important to capitalize on the peak moments and create teachable moments around them. It's all about special experiences that awaken and engage the senses, resulting in "Wow!"

Multiple advisors from the informal education community have suggested not pushing a mission before major events, and relaxing the perceived need for constant and consistent attention on Mars missions. People will enjoy them in the excitement of the moment, and will come back for more when mission events are taking place. A particular caution is to avoid the production of "trade-show-style" exhibitry, and focus instead on powerful visualizations that create a sublime experience. Producing replica rovers to place in museums are considered to be as good, or better, than any exhibit. The opportunity to

buy-in on such orders would also be appreciated. Rovers are "celebrities," and can provide a draw for all audiences.

3.6 PLANNED INFORMAL EDUCATION ACTIVITIES

Key Informal Education activities are organized by focus areas, or "threads." Following a brief description, a "mini-roadmap" is provided for each activity (extracted from the overall roadmap in Appendix D for easy referencing).

3.6.1 Informal Education Thread 1: Networks and Alliances

ACTIVITY A. VISUALIZATION ALLIANCE

Museums, science centers, and planetaria are venues for the public to "ride along" on NASA missions. The Mars Public Engagement team will work with an alliance of science centers, museums, and other informal education partners to disseminate collections of imagery for significant exhibition displays and large-screen viewings. Participating institutions want special access that would distinguish their institutions from the news media's appetite for short, immediate blasts of news and video. They also have asked for assured and uninterrupted access to visualizations, something that can prove challenging if they are competing on the internet with hundreds of thousands of interested members of the public.

Therefore, Mars Public Engagement will invest in a requisite infrastructure that will provide dedicated servers and bandwidth. Satellite downlink opportunities will also be widely publicized through museum networks and associations.

To be prepared for disseminating images during Mars Exploration Rover mission landings and subsequent Mars mission events, Mars Public Engagement will work closely to advertise the opportunity to the museum community through organizations such as ASTC. A small organizing and advisory committee of museums with expertise in imaging and distance-learning would be critical to designing and beta-testing a program that works according to their interests and needs. The success record of those who participated in holding live, large-screen eclipse events at their institutions (broadcast from another part of the world) could also contribute valuable lessons learned. The goal is to provide images and image streams in real-time to museums participating in the alliance. Because museums are not all the same and do not have the same technical capabilities and varying formats and equipment, an understanding of user needs is essential. Organizations with large numbers of museum memberships (e.g., the Association for Science and Technology Centers) can be instrumental in helping identify varying needs through membership surveys and other means.

Just as Mars Public Engagement staff participate in "Operational Readiness Tests" along with mission teams (as was accomplished for the first time for Odyssey's Mars Orbit Insertion), similar operational readiness tests will have to be performed with participating members to ensure success during actual events. The potential for outreach to the public

is huge, as pre-advertised live events at museums around the country would allow immediate and immersive experiences that would engage the public as if they were right there with the mission teams for "The Moment."

The Visualization Alliance represents one of the most fundamental ways of meeting the vision of Sharing the Excitement and Making Mars a Real Place. It helps meet Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity) and Goal 5 (Infusion of New Ideas) from our informal education partners. These Goals are met through Objective 1 (Visualizations and Virtual Experiences) created at museums, Objective 2 (Strong Networks) of participants, Objective 3 (Easy, Assured Access), and Objective 5 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: VISUALIZATION ALLIANCE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Create Visualization Alliance for real-time shows during MER landing and operations.	Build on initial Visualization Alliance partners for future missions as more informal education institutions add new technology capability and programming.	

ACTIVITY B. SOLAR SYSTEM AMBASSADORS

This program competitively selects some 200 competent science education volunteers from across the country, many of whom are affiliated with informal education institutions. Each Ambassador receives training and materials related to solar system exploration, and then holds a minimum of four public events in their local region, ranging from exhibits in shopping malls to slide shows at concerts. For example, one Ambassador created a musical theater production to deliver facts about Mars through music and performance art. In FY00, fifty percent of all Ambassador events were Mars-related and about 250,000 people were reached with Mars messages. In FY01, with a growing number of participants, 56% of all Ambassador events were Mars-related, and the audience reached totaled more than 500,000.

Goals for the program are continued expansion, with numbers of Ambassadors in FY02 expected to be at 300 and potentially increasing from there in a sustainable way. Plans are currently in the works to build a framework for handling even larger numbers of participants, with special roles being created for "lead" Ambassadors who can mentor others. Mars Public Engagement will continue to develop common materials (presentations, slide sets, videos etc.) for use by Ambassadors, as well as link them to scientists through web chats and telecons in order to answer their questions and keep them up-to-date. Mars Public Engagement staff will also link Ambassadors with formal and informal educational partners in their local areas.

Solar System Ambassadors carry the story of Mars exploration far and wide. They are able to Share the Excitement and Make Mars a Real Place through their innovative interactions with the public. This program helps meet Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity) by reaching diverse peoples, and Goal 5 (Infusion of New Ideas) by the Ambassadors. These Goals are met through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks), Objective 3 (Easy, Assured Access), and Objective 5 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles, especially: B (Content) and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity B: SOLAR SYSTEM AMBASSADORS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Continue to expand participants in Solar System Ambassadors.	Have a specialized cadre of Mars Ambassadors in all 50 states.	

ACTIVITY C. SPACE PLACE

More than a web site, the Space Place is a NASA-sponsored, nation-wide, space-science, education initiative. The program engages young people to participate in cross-curricular activities that provide hands-on experiential learning opportunities. Partnering with a number of national organizations dedicated to the education and well-being of children and youth, the Space Place program provides science- and technology-related activities and materials to these organizations, which they then distribute through their considerable infrastructures. Currently, Space Place partners include Boys & Girls Clubs of America (3000 Clubs across the country, serving 3,000,000 children); YWCA (326 chapters over all 50 states, serving about 750,000 girls and women); the International Technology Education Association (8,000 members and an educator journal featuring a Space Place article each month); the 21st Century Community Learning Centers (a program established by Congress to award grants to rural and inner-city public schools to provide safe, drug-free, supervised and cost-effective after-school, weekend or summer havens for 600,000 children, youth and their families); and, the Civil Air Patrol (a nonprofit, humanitarian corporation with a membership of 60,000 and an aerospace education program for cadets aged 12-18). The Space Place also conducts outreach to a network of small museums, libraries, planetaria, zoos and aquariums across the country, based on its award-winning, expanding web site for younger children. Each of these places has a special display board or wall with regularly updated NASA materials.

Mars Public Engagement will continue to provide materials for the regular mailings to Space Place partners and will selectively fund the development of Space Place activities with the potential for high impact. More important than Mars activities, however, is the continued expansion of participating organizations, as new partners will allow greater numbers of people to be reached.

The Space Place helps further efforts to Share the Excitement and Make Mars a Real Place by reaching smaller museums and libraries and a variety of youth programs. In doing so, Space Place outreach helps meet Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 5 (Infusion of New Ideas). These Goals are met through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks), and Objective 3 (Easy, Assured Access).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity C: SPACE PLACE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Continue to expand participants in Space Place and assess participant interests for future directions.	Leverage early relationships with partners to form new alliances based on the input from participants.	

ACTIVITY D: LONG-TERM PARTNERSHIPS WITH MUSEUMS RECEIVING NASA GRANTS

Mars Public Engagement will also participate in collaborations with Congressionally mandated, NASA-funded efforts (e.g., Adler Planetarium, Ft. Lauderdale Museum of Science and Discovery, Charlotte Discovery Place, South Carolina State Museum, Louisville Science Center, the Glendale Science Center, the Chabot Science Center, the Boeing Facility in Downey etc.). All receive NASA grants and corporate funding to develop local science and technology learning centers, and are major regional attractions that desire a continuing relationship with NASA. The Space Science Support Network's Broker/Facilitators will be sought to act as agents in helping to form connections.

Partnerships have the potential to enhance the vision, goals, and objectives outlined in this plan. In particular, they can support Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 5 (Infusion of New Ideas). These Goals are met through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) of participants, and Objective 3 (Easy, Assured Access), and Objective 5 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity D: LONG-TERM PARTNERSHIPS WITH MUSEUMS RECEIVING NASA GRANTS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Initiate Partnerships with Museums Receiving NASA Grants and assess opportunities for collaboration.	Have a manageable program in place for maintaining and serving ongoing relationships, based on a needs and desires assessment of the institutions involved.	

ACTIVITY E: NATIONAL PARKS INITIATIVE

Our national parks provide the greatest analogue for geologic processes on Mars. Mars Public Engagement will form alliances with the National Parks Service, their natural historians, and their interpretive rangers (many of whom are classroom teachers during the school year and seasonal summer Park Service employees) to infuse Mars information into discussions of astronomy, geology, geography, biology, and history. Interpretive rangers will be invited to apply to become Solar System Ambassadors. Educational field trips to specific locales will be planned for students of all ages, including Elderhostels. The opportunity to place small Earth/Mars comparison exhibits in Mars-like areas (e.g., Grand Canyon, Yellowstone, Death Valley etc.) will also be pursued, along with professional development opportunities for National Park interpretive rangers and other staff to meet with and learn from Mars scientists. Professional development opportunities could be combined with those planned in Section 3.6.3 of this plan.

While Sharing the Excitement, this Initiative has the potential to contribute particularly to the vision of Making Mars a Real Place. It could serve Goal 1 (Communicate the Story) through Objective1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) among National Park participants, and Objective 4 (Easy, Assured Access).

This activity supports NASA Strategic Goal 6 (6.1.3, 6.2.3, 6.3.4) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity E: NATIONAL PARKS INITIATIVES		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Identify national parks that are "Mars on Earth" sites and form an alliance to discuss and assess the possibilities (e.g., Earth/Mars displays, interpretive ranger professional development etc.).	Successfully implement National Parks Initiative, with Earth/Mars displays in major Mars analogue sites here on Earth and professional development opportunities for key national park staff.	

3.6.2 Informal Education Thread 2: Models & Materials

ACTIVITY A: SPACECRAFT MODEL LOAN PROGRAM

Mars Public Engagement funding will continue to produce spacecraft models for loan to museums and other venues. In response to high demand for additional models, Mars Public Engagement will consider the production of greater numbers of the most popular models for loans, but will also widely publicize opportunities to buy-in on orders. The goal will be to have as many MER rovers and other displays in informal education environments, and build on that experience by the time of the Smart Lander, Scout, and Sample Return missions. For long-term participating museums, it will even be possible to build up a set of rovers that display size comparisons of the rovers, which has been a popular exhibit with the public as it provides an instant visual understanding of dimensions, serving to make them more "real" to people.

The vision of Sharing the Excitement and Making Mars a Real Place are furthered through models and exhibits that bring the Mars Exploration Program to communities all over the country. This Program serves Goal 1 (Communicate the Story) and Goal 2 (Diversity and Educational Equity) through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) among participating museums, Objective 4 (Easy, Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.3, 6.3.4) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: SPACECRAFT MODEL LOAN PROGRAM		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Initiate more accessible model loan program and allow museums to buy in on MER rover models by advertising the opportunity through association and other networks.	Have Mars models in locations nationwide and well-recognized program for model loans.	

ACTIVITY B: PRODUCT DISSEMINATION TO INFORMAL EDUCATION ASSOCIATIONS

Products include videos, slide sets, CD-Roms, and activity books that keep informal educators up-to-date and provide raw materials for education and entertainment. In the near-term, Mars will continue to work closely with two organizations in particular, and will seek to identify future initiatives of mutual benefit.

The Association of Science-Technology Centers (ASTC) is an organization of science centers and museums dedicated to furthering the public understanding of science. ASTC

encourages excellence and innovation in informal science learning by serving and linking its members worldwide and advancing their common goals. Through a variety of programs and services, ASTC provides professional development for the science center field, promotes best practices, supports effective communication, strengthens the position of science centers within the community at large and fosters the creation of successful partnerships and collaborations. Mars Public Engagement staff have effectively used ASTC newsletters and other communications means for advertising opportunities, and plan to continue to use such communications links to members as a means of connecting. To give an example, Mars Public Engagement publicized the opportunity for members to receive a copy of the pre-launch video for the 2001 Mars Odyssey mission, which depicted the goals, science, and excitement of the mission. As a result of this communique, nearly 100 museums and science centers responded (of a total 230 list of museums, planetaria, and libraries). This effort was a first attempt to determine initial interest, and then to send out a product accordingly at the request of organizations (rather than just a blanket mailing). Feedback was also collected and incorporated into "lessons learned" for future endeavors (e.g., for the Museum Visualization Alliance, section 3.6.1 Activity A).

The International Planetarium Society (IPS) is a professional organization of planetaria worldwide. Planetaria are the front-line for fielding questions from their local media whenever there is an astronomical event (such as a comet apparition, a meteorite sighting, events at NASA). Mars Public Engagement will continue to provide IPS (geographically distributed in 24 locations worldwide) with high-quality, reproducible slides and video of planetary mission plans and results for use in their exhibits, talks, and planetarium shows. IPS distributes these products on a cost-recovery subscription basis to its 2400 planetaria membership worldwide, with annual audiences in the tens of millions.

The informal education community extends beyond museums, planetaria, and science centers to various civic groups and after-school programs. Research needs to be conducted on which groups would be interested in working with us. The National Storytellers Association has responded positively in early discussions, and the Solar System Forum is currently assessing ways to work more closely with the Girl Scouts, 4-H, and amateur astronomy groups to name a few. HUD also sponsors a number of community-based educational programs for students that the NASA Robotics Education Program has begun to tap into through distance learning programs. Identifying potentially interested groups and understanding their needs and desires is the first step. In the long-term, building an easy-to-access dissemination system to these groups is the goal.

This dissemination opportunity has the potential to enhance the vision, goals, and objectives in this plan. It particularly helps meet Goal 1 (Communicate the Story) and Goal 2 (Diversity and Educational Equity) in reaching more audiences. These Goals are furthered through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks), Objective 4 (Easy, Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

The best means of connection and dissemination to other informal education groups (e.g., youth groups, community groups, special-interest groups etc.) will be assessed, and the appropriate dissemination "machinery" for each of these identified groups will be developed.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity B: PRODUCT DISSEMINATION TO INFORMAL EDUCATION ASSOCIATIONS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Assess needs and desires, create a plan, and research and implement dissemination means beyond those currently known to informal education organizations and other groups (e.g., youth, community, special-interest)	Have in place easy-to-access systems for new, data-rich materials that the informal education community desires.	

3.6.3 Informal Education Thread 3: Informal Educator Professional Development Opportunities

ACTIVITY A: INFORMAL EDUCATOR WORKSHOPS

A previous museum survey indicated that museums would like to have NASA scientists come to update them on the latest discoveries, so that informal educators have the most recent news and can design their own exhibits (rather than for NASA to do so or to send a traveling exhibit). This effort supports travel expenses for scientists and engineers who will participate in Mars-related seminars in regions around the country, as well as content development. As much as possible, this program will capitalize on the relationships that the Space Science Support Network Broker/Facilitators have built with informal education institutions in their regions, and will strategically seek to reach areas that aren't directly covered by them.

In the near-term, a pilot professional development program for informal educators is being created in cooperation with the Space Science Institute in conjunction with its traveling Marsquest exhibit. Wider programming and content will also be co-developed and tested by request of the coalition of California Challenger Centers and others for effectiveness and desirability.

Once the informal educator workshops have been piloted, the goal will be to have frequent workshops in every state in the nation, with a measurable customer satisfaction rating.

These workshops will enhance the vision of Sharing the Adventure and Making Mars a Real Place as informal educators learn more about recent events related to Mars exploration and can carry that knowledge forward in their own efforts. Workshops help meet Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), and Goal 5 (Infusion of New Ideas) through Objective 1(Visualizations and Virtual Experiences), Objective 2 (Strong Networks) Objective 4 (Easy, Assured Access), and Objective 6 (Real-time Data and Information and Real-time Expert Interactions).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.2) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity B: INFORMAL EDUCATOR WORKSHOPS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Initiate, pilot and assess workshops for informal educators and begin to hold them regularly in regions around the country.	Have in place a solid, recognizable, and successful program that reaches all states and is highly responsive to feedback from participants.	

3.7 INTRODUCTION TO PUBLIC INFORMATION AND OUTREACH

Meeting the dual goal of reaching nationwide, yet remaining personal and community-based, is certainly a challenge. To reach wide audiences, television and the internet are two visually based dissemination means that can carry Mars messages, not once, but again and again. Demand is increasing for web and television visuals, and these formats are two of the best ways to get data out quickly and impressively. Mass media (print, broadcast, and internet), however, must be complemented by programs that reach into the heart of communities. Work with formal and informal education institutions will help accomplish this goal, but there are select public outreach efforts (particularly those that are low cost and easily reproducible) that can make a connection with Mars exploration and life on Earth particularly meaningful.

Internet and Media Support Initiatives

The missions in the Mars Program have a commitment to providing real-time (or as near real-time as possible) data to the public, but a number of infrastructural investments will be needed to ensure delivery (e.g., expanded bandwidth, servers that can accommodate numerous high-resolution images from current and future missions, real-time image delivery capability etc.). Just as participating scientists need dedicated bandwidth to assure uninterrupted access, high-leverage partners (e.g., museums that can hold live, real-time events in conjunction with mission events) may as well. For general public audiences, demand for streaming video during mission events already exceeds NASA and Center resources. Co-investments in this area are thus vital. In coordination with NASA, investments will also be necessary in high-definition television filming and broadcasts so that the public can have the best views of Mars, as well as real-time experiences as key mission events unfold.

Development of engaging, public-friendly web pages will continue to be a high priority. Web hits go up the minute sites appear on major search engines, so partnerships with search engine providers to feature and link to the Mars web sites could make a difference in exposure.

While the Mars Public Engagement program will continue to provide paper products for under-represented areas as needed, web and television dissemination mechanisms can allow delivery on demand of large quantities of static and dynamic information. For cost-effectiveness, Mars Public Engagement will work with creators of print materials with large distributions. For example, the Mars maps recently produced by National Geographic reached more readers and classrooms than could have been achieved through internal production and dissemination mechanisms alone.

Media support initiatives include efforts to supplement traditional media-relations efforts. By supporting the creation of documentary footage of missions and mission teams at all stages, providing expanded press kits, and creating new relationships with nontraditional media, it will be possible to tell the story of Mars exploration to wider audiences in new and continuous ways. Only through constant telling and retelling, visualizing and re-

visualizing, can a long-term awareness of Mars and Mars Exploration begin to emerge in the public.

Community-building Initiatives

Many public talks are sponsored through speaker support funds (see Section 3.2.4) or through informal education programs such as Solar System Ambassadors (see Section 3.6.1). In addition to these ways of interacting in communities nationwide, some programs can be developed that not only raise a consciousness of Mars exploration, but also of community life here on Earth. Such programs include an environmental initiative that uses comparisons between Earth and Mars to raise an awareness of precious resources (such as clean water) here on Earth. Also proposed is a time capsule program that would enable communities to reflect on life in this era of space exploration and leave a legacy to the future when the time capsules are opened (perhaps when the first human arrives at Mars).

Commercialization

One under-utilized way of reaching the public is commercialization, as Mars-related products (e.g., computer games using real Mars data) could create an awareness of the planet and the exploration taking place there. In the long-term, subject to allowability and NASA policy, the goal will be to generate a revenue stream that can flow back into the Mars Public Engagement Program. Such funds would potentially generate an ability to invest in more science, engineering, mathematics, and other space-related education for the public overall, and for teachers and students in particular.

3.8 PLANNED PUBLIC INFORMATION AND OUTREACH ACTIVITIES

Key Public Information and Outreach activities are organized by focus areas, or "threads." Following a brief description, a "mini-roadmap" is provided for each activity (extracted from the overall roadmap in Appendix D for easy referencing).

3.8.1 Public Information and Outreach Thread 1: Internet Initiatives

ACTIVITY A: EQUIPMENT AND INFRASTRUCTURE

Users of the Internet are rapidly expanding. According to Nielson/NetRatings, nearly half a billion people around the world had access to the Internet from their homes by the end of 2001. This jump was up 5.1% from the third-quarter (July-September) of 2001. Forty percent, or about 200 million people with internet access from their homes, are from North America. Couple this kind of growing demand with increased image and video capabilities, and it's clear that a number of investments must be made to keep up and to ensure near-real-time data delivery, particularly during major mission events when spikes in demand are not only likely, but definite.

Trends from Pathfinder onward show growing numbers of visitors, both in "normal" times and during peak mission events. During Odyssey's Mars Orbit Insertion, for example, NASA, JPL, and KSC all "maxed out" in terms of the number of visitors to whom they could stream the live event. With the number of internet users growing significantly and with image and video content capabilities also expanding, it is imperative to make investments in equipment (e.g., more and more capable servers to handle all of the data now coming back from multiple Mars missions, as well as video and other content that requires server space) and in infrastructural solutions (e.g., web investments with strategic partners that have: distributed hosting capability, multiple streaming video channels with substantial bandwidth, real-time database driven dynamic web page generation, virtual reality tools to show rover location and views etc.).

Such investments are absolutely necessary to ensure that the public can access the Mars Exploration Program's science returns. While they are often costly, these investments support information dissemination not only to the general public, but also to museum, media, and other partners that are engaged in communicating the excitement and the results of Mars missions.

In addition, since the Mars site has been among the top ten visited NASA/JPL sites, Mars Public Engagement has special requirements to ensure fair and equal access to information for people with disabilities (per an accessibility law known as Section 508). While there is no argument that this goal is incredibly important and connects with a key value in this plan of ensuring Opportunities for Under-represented Audiences, expenses associated with compliance can be high. For example, multimedia content (e.g., Quicktime, AVI, MPEG, Flash, WAVE, MP3, AIFF, TIFF etc.) are convertible to either accessible formats or alternative formats, but this effort requires additional staff time and resources and typically requires more time to produce, which can sometimes compete with the need for timely (near-real-time) dissemination. Mars Public Engagement will therefore invest in staff and software to meet this need and, in the meantime, as the NASA guidance suggests, provide contact information for users of assistive technology who cannot easily access Mars web content and would like to request an alternative method of receiving the information.

Internet investments in equipment and infrastructure highly support the vision of "Sharing the Adventure" and "Making Mars a Real Place" as they allow individual exploration of images and science results. This Activity meets Goal One (Communicate the Story of Mars Exploration), Goal 2 (Diversity and Educational Equity), and Goal 4 (Direct Public Involvement) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy, Assured Access), and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.1-4, 6.3.1-4, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles. See Appendices I and J.

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ROADMAP Activity A: Internet Equipment and Infrastructural Investments		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Assess needs and make investments, particularly in relationship to the 2003 rover mission, and begin to implement accessibility requirements.	Continue to research and invest in future technologies and capabilities enhance the public's access to data and to a "virtual" experience with Mars and its exploration and maintain a capability to deal with peak demand during key mission events.	

ACTIVITY B: WEB CONTESTS AND INTERACTIVE FEATURES

Other than being featured on major search engines, what draws people to web sites repeatedly is the chance to "win" through web contests. Mars Public Engagement has the unique ability to sponsor everything from mission naming contests to Mars art, literature, and science contests to actual prize participation in mission events or education and outreach activities. The number and kind of contests will be carefully balanced to ensure that people have enough opportunities to participate, yet aren't ultimately disenchanted by relentless contests that lose meaning over time. Public participation in these contests will be closely assessed to determine interest levels (hits, visits, feedback etc.) in the type and frequency of contests.

Contests might bring people to a web site, but what will keep them there and returning again? Interactive features that create virtual experiences of Mars could play a large role. Particularly as Internet capabilities grow (bandwidth, applications etc.), the potential for creating captivating virtual experiences of Mars exploration will be enormous. Interactive, 2-D and 3-D gamelike environments could prepare people for the data returned from Mars missions, so that they are already familiar with the kinds of discoveries that might be possible, as well as with problem-solving exercises that must occur in the course of any mission (e.g., safe mode, real-world trouble-shooting scenarios such as Sojourner getting "stuck" against a rock etc.). To personalize the experience of exploration, near-real-time data could be delivered in ways that allow user-selected "tours" of the martian terrain and interactive, discovery-driven exploration. Expanding virtual collaboration (e.g., students looking at data and interacting with one another in real time) is particularly possible in the near- and mid-term, as is the pursuit of easily downloadable software that makes scientific data (especially images) both accessible and fun to work with.

While no one can fully predict the direction web technologies will take, research and development is currently underway in the private-sector to develop hardware and software that allow touch and other sensory experiences. Over the long-term, making use of such web-based technologies for tactile, aural, and other sensory experiences could

also be pursued in order to enable people to have a greater sense of "being there," where "there" can mean a laboratory, a clean room, the launch pad, or the surface of Mars itself. While fun and immersive for anyone, such experiences would also potentially provide augmented reality-based experiences for the deaf and blind, along with any other people who use assistive technologies and require alternative means of receiving information and interacting with others.

With all of these exciting possibilities, the Mars Public Engagement program does face a challenge in balancing the need to be available to all users, and yet continue to keep up with web technologies as they progress. Some early investments in interactive web programs that give people a virtual experience will allow the Mars web capability to grow, yet every effort will also be made to ensure there is a viewing option for those with lower home, school, or community computer capabilities (e.g., low bandwidth, outdated computer systems etc.). For example, videos can be split into stills for "slide shows" with captions. Compliance with accessibility laws will also be a high priority, as addressed in Activity A of this section.

Web contests and interactive, multimedia, and multi-sensory features are good ways to Share the Excitement. Interactive features in particular promote the ability to Make Mars a Real Place. This Activity meets Goal 4 (Direct Public Involvement) and Goal 5 (Infusion of New Ideas) through Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles. See Appendices I and J.

<table>
<tr><th colspan="3">ROADMAP
Activity B: WEB CONTESTS</th></tr>
<tr><th>Near-term (FY02-FY04)</th><th>Mid-term (FY05-FY10)</th><th>Long-term (FY11-FY20)</th></tr>
<tr><td>Hold web contests to attract interest and assess participation and begin developing interactive web features.</td><td colspan="2">Provide a wide-range of exciting interactive features that create virtual experiences.</td></tr>
</table>

ACTIVITY C: MARS EMAIL PROJECT

Using artificial intelligence techniques and a "natural language auto responder," this project will allow members of the public to ask a computer character questions about Mars. Initially, this computer character will learn to talk in a natural manner. In the first stage, internet users will be able to ask questions and have them directly and immediately answered by the character (e.g., "Dr. Dish," based on the Deep Space Network) in an interactive way. This tool will alleviate staff pressures in responding to the numerous public inquiries that come in through email.

Eventually, this technique will allow the public to make contact with spacecraft at Mars by sending an email to it. Someone could ask a rover, for example, "How cold it is on Mars today?" The autoresponder software on the rover would access the same information mission controllers consult, but then change the technical computer languages into "natural language." This project introduces the public to the idea of an interplanetary Internet, which is proposed for Mars in the future.

This project helps meet the vision of Sharing the Excitement and Making Mars a Real Place as people increasingly have the chance to interact with virtual spacecraft characters and later maybe even real ones. This Activity meets Goal 1 (Communicate the Story) and Goal 4 (Direct Public Involvement) through Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and all NASA Office of Education Operating Principles, especially: A (Customer Focus) and B (Content). See Appendices I and J.

ROADMAP Activity B: MARS EMAIL PROJECT		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Work with scientists and engineers to provide content supporting Mars Email Project.	Work with scientists and engineers toward use and popularity of interactive Mars email program, and develop the potential for emails to be sent to spacecraft in the future.	

ACTIVITY D: MARS @ HOME

This proposed project will create a "Digital Mars" that will allow people to tour the red planet from the comfort of their homes. Users will be able to visit dramatic landscapes, seeing individual images and panoramas taken by orbiters, landers, rovers, and scouts. Perhaps it would also be possible to set up a system that allows people to process Mars data on their home computers, much as happens with the SETI @ home.

This project helps meet the vision of Sharing the Excitement and Making Mars a Real Place by allowing people to explore on their own and make their own discoveries. This Activity meets Goal 1 (Communicate the Story), Goal 4 (Direct Public Involvement), and Goal 5 (Infusion of New Ideas) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.1, 6.2.3-4, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially B (Content). See Appendices I and J.

ROADMAP Activity D: MARS @ HOME		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Invest in visualizations for a "Digital Mars" experience that people can enjoy at home.	Develop measurable and dramatic demand in downloads for "Digital Mars" data and interactive programs.	

ACTIVITY E: RED PLANET CLUB

The Red Planet Club will be a national (maybe international) confederation of individuals interested in Mars Exploration. Membership benefits could include special updates, "advance information" on plans, and other opportunities to create value and excitement. It could involve every element of society: students, teachers, families, enthusiasts, artists, scientists, and so on. While primarily web-based, alternative membership opportunities will be pursued so that non-internet-users may be included as well.

The Red Planet Club would give the public a way of being "part of the Mars exploration team" and having access to Mars images and discoveries in a way helps meet the vision of Sharing the Excitement and Making Mars a Real Place. This Activity has the potential to meet Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), Goal 4 (Direct Public Involvement), and Goal 5 (Infusion of New Ideas) through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks), Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1, 6.2.1, 6.3.1, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and C (Pipeline). See Appendices I and J.

ROADMAP Activity E: RED PLANET CLUB		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Assess process, structure, and resource needs for a Red Planet Club.	Nationwide members of Red Planet Club, with assessment of participant satisfaction.	

3.8.2 Public Information and Outreach Thread 2: Media Support Initiatives

While traditional public outreach events like public lectures and exhibits at fairs and shows can give the public opportunities to connect with the Mars story, these events are typically only one-time opportunities to interact, tend to reach limited numbers of people, and only for short periods of time. While the media also reaches people in short "bites," it is through the constant and continuous telling and retelling, visualizing and re-visualizing, that a long-term awareness can begin to emerge. In the future, Mars Public Engagement plans on capitalizing on mass media approaches that have the potential to reach millions--again and again.

ACTIVITY A: DOCUMENTARY FOOTAGE

Recent media inquiries and public survey responses have identified an increased desire for "behind the scenes" looks at missions and the people involved in them. From the public, it is a call for "Real TV" that features real people pursuing difficult tasks and it allows them to "know" the people, the characters in the story, and identify with them. From the media perspective, expressed desires reflect a mix of historical, educational, and entertainment goals. The highest priority for the Mars Program is the success of its missions, with nothing interfering with the effectiveness of the teams. However, with that in mind, Mars Public Engagement staff will work with the mission teams to ensure that documentary coverage of key moments in all mission phases is captured at least by internal videographers and, with discretion, by external documentarians as well.

Documentaries are one of the primary ways to Share the Adventure and to Make Mars a Real Place as they give a real-time, insider's view of the mission as it happens and allows Mars to be portrayed as the exciting and exotic destination it is. This Activity has the potential to meet Goal 1 (Communicate the Story), through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-3, 6.2.1, 6.2.3, 6.3.1, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: B (Content) and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: DOCUMENTARY FOOTAGE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Begin documentary films and regular dissemination and assess public interest.	Have in place a user-friendly, online system for easily accessing beginning-to-end documentary coverage of missions, with measurable increases in downloads from media and the general public.	

ACTIVITY B: EXPANDED PRESS KITS AND INFORMATION

Traditional press kits deliver all of the basic information that the media needs to cover the story. Feedback has been positive on the level, breadth, and depth of content. However, a suggested initiative for the future is to develop expanded press kits and press contacts that would make it easier for media representatives to identify expanded story lines. Mission specs and scientific goals can then be enhanced in the context of what appeals to a wider variety of readers and viewers. This material can also be used by the informal education community and placed on the web.

Expanded press kits and information will help meet the vision of Sharing the Adventure by creating materials for expanded story lines on the mission team members and

spotlights on what it takes to get a mission to Mars. Making Mars a Real Place can also be enhanced through information about the various regions of Mars to be explored and the visualizations to make these stories even more attractive for print or web publishing or for broadcast. The information for these expanded press kits will also be made available for informal educators

This Activity has the potential to meet Goal 1 (Communicate the Story) through Objective 1 (Visualizations and Virtual Experiences), Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-3, 6.2.1, 6.2.4, 6.3.1-2, 6.3.4, 6.4.1-3) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles, especially: A (Customer Focus), B (Content), and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity B: EXPANDED PRESS KITS AND INFORMATION		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Work with mission teams to create information for expanded press kits.	Have in place a system for disseminating expanded press kits, especially to local media outlets where Mars work is being conducted around the country.	

ACTIVITY C: NEW RELATIONSHIPS

Much more work can be done to aid and supplement media outreach efforts to non-traditional (i.e., non-science or non-technology) media. Mission team members could be featured as "hometown heroes" in their local papers and alumni magazines, and some could be featured as role models in teen magazines and children's Saturday morning science programming. A near-term goal is to create partnerships with broadcast stations (e.g., Knowledge is Power radio program) and to facilitate placement of Mars content and Mars personalities in top print, broadcast, and internet media every month (e.g., GQ, Popular Mechanics, Good Morning America waves from the teams, etc.). Special initiatives for coverage would include girl's and women's magazines, media geared for retirees, young men's and men's magazines, travel and lifestyle publications, environmental magazines, and ethnic and regional publications.

Building on recent successes with the Spanish-language press (broadcast and print), new relationships with under-represented and minority press will be actively pursued. Whenever possible, press opportunities will be made in multiple languages, drawing on the rich backgrounds of the people who work in the Mars program. Featuring cultural, language, ethnic, gender, and other diversities will not only bring Mars exploration to people who wouldn't otherwise learn of it, but will also inspire children from diverse backgrounds to believe that they too may become a scientist, engineer, technician, artist, accountant, or any of the numerous positions available in space exploration.

This Activity has the potential to enhance the vision, goals, and objectives outlined in this plan. In particular, it serves Goal 1 (Communicate the Story) through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) created through long-term relationships, Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.3, 6.3.4) and Goal 7 (7.1.1-2) and NASA Office of Education Operating Principles, especially: B (Content) and F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity C: NEW RELATIONSHIPS		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Begin to form long-term relationships with nontraditional and minority press.	Have a routine, yet proactive, program in place for outreach to nontraditional press, with the goal of seeing a measurable increase in Mars stories covered.	

3.8.3 Public Information and Outreach Thread 3: Community-building Initiatives

ACTIVITY A: ENVIRONMENTAL INITIATIVE

From an on-line public survey, one in three respondents said that the reason to explore Mars is because humans are ruining the Earth and that Mars gives humans the hope of a second chance for survival. Mars Public Engagement should not dismiss this concern, but should seek instead to address it honestly and proactively. Clearly, it is much easier to take sound measures that educate people in simple and direct ways of how to protect the Earth environment (e.g., water efficiency measures for households) than to turn the whole (and hostile!) planet Mars into a habitable place for humankind to live.

Given the Mars Program's "Follow the Water" science theme, one obvious area to address is water as an essential Earth resource. Mars Public Engagement will seek to work with environmental agencies and other organizations to inspire appreciation for this resource on Earth, particularly given its importance to life here and, potentially one day far in the future, on Mars.

This initiative is meant to be bi-partisan in orientation. In the near-term, it supports the President's environmental agenda for Clean and Safe Water, which is defined as Goal 2 in the President's FY03 Funding Request for the Environmental Protection Agency:

> **Clean and Safe Water :** All Americans will have drinking water that is clean and safe to drink. Effective protection of America's rivers, lakes, wetlands, aquifers, and coastal and ocean waters will sustain fish, plants, and wildlife, as well as recreational, subsistence, and economic activities. Watersheds and their aquatic ecosystems will be restored and protected to improve public health, enhance water quality, reduce flooding, and provide habitat for wildlife.

Mars Public Engagement will assess opportunities to partner with federal, state, and local agencies and other programs to help get messages out to the public on the importance of water as a resource. Using Mars as a way to enhance the message might open doors and raise awareness in a unique and fun way through comparisons of environments on Mars and on Earth.

An additional opportunity might also be explored in support of Goal 8 in the President's FY03 Funding Request for the Environmental Protection Agency:

> **Sound Science, Improved Understanding of Environmental Risk, and Greater Innovation to Address Environmental Problems:** EPA will develop and apply the best available science for addressing current and future environmental hazards as well as new approaches toward improving environmental protection.

NASA also shares the goal of sound science and seeks to communicate the scientific process of inquiry in its educational programs. Additionally, Mars scientists are attempting to understand global climatic, geologic, and possible biogeochemical cycles on another world, in a way that can also assist in our understanding of these same cycles on Earth by comparison. Opportunities to showcase scientists who are studying Earth and those studying Mars might also be explored in ways that enhance current and future policy goals that relate to both education and to the environment.

In addition, as previously discussed in risk communications efforts (see Section 3.2.1), Mars Public Engagement staff will also work with appropriate NASA/Mars offices to create helpful public information and communications products related to planetary protection issues associated with Mars missions. In accordance with the Mars Exploration Risk Communications Plan, every effort will be made to hear and incorporate diverse and multicultural views.

Collaboration on any of these areas would focus on general education and information. Just as NASA is committed to interagency and private-sector partnerships in communities around the nation, the current EPA Plan also calls for strong partnerships and innovative approaches, especially through local community-, tribal-, and state-based initiatives and programs.

This activity can help promote the vision of Mars as a Real Place through Earth/Mars comparisons and of Sharing the Adventure through communications about Mars as a hostile world posing risks to be overcome. This Initiative serves Goal 1 (Communicate the Story), Goal 2 (Diversity and Educational Equity), Goal 3 (Communicate the Mission Safety) and Goal 4 (Direct Public Involvement). These goals are accomplished through Objective 1 (Visualizations and Virtual Experiences), Objective 2 (Strong Networks) created through long-term relationships, Objective 4 (Easy, Assured Access) and Objective 6 (Real-time Data and Information and Real-time Interactions with Experts).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4) and Goal 7 (7.1.1-3) and NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity A: ENVIRONMENTAL INITIATIVE		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Make contact with potential partners (e.g., environmental organizations focused on water resources) and evaluate possible relationships.	Have in place widely recognizable partnerships that encourage education on water quality and efficiency (or other suitable areas) in alignment with federal, state, and local goals.	

ACTIVITY B: MARS TIME CAPSULE PROJECT

This proposed national program would offer children (and adults) a chance to place keepsakes in a time capsule to be opened when the first humans step foot on Mars. Time capsules could be placed on school grounds, in community centers, libraries, town halls, and other civic and community learning centers. This program would give children a chance to imagine a future world on Mars and to reflect on the best things about their home communities. Perhaps it would also give them a chance to revisit their dreams as adults. If humans go to Mars within their lifetimes, they'll have the opportunity to celebrate a milestone event in human history by unearthing their time capsules and all the wishes that went into them. If humans go to Mars much later, there would be a nationwide legacy left from this generation to those who will follow. In the meantime, this activity provides a community-building experience that is low-cost, and thus available to all communities, regardless of income level.

The Mars Time Capsule Project is a direct means by which the public can Share the Adventure of Mars and Make it a Real Place to them. It supports all five goals (Communicate the Story; Diversity & Educational Equity; Communicate Mission Safety—in terms of risks to humans and why we aren't sending people to Mars at present; Direct Public Involvement; and, Infusion of New Ideas). These goals are potentially served primarily through Objective 1 (Visualizations and Virtual Experiences), created by communities through their interest and imagination, and Objective 4 (Easy, Assured Access). See Appendix E.

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.2.3, 6.3.1-2, 6.3.4, 6.4.2) and Goal 7 (7.1.1-2) and NASA Office of Education Operating Principles. See Appendices I and J.

ROADMAP Activity B: MARS TIME CAPSULE PROJECT		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Pave the way for a Mars Time Capsule Project by identifying necessary resources and relationships.	Have time capsules in all 50 states.	

3.8.4 Public Information and Outreach Thread 4: Commercialization

Commercialization of Mars-related products and activities is conducted by JPL's Business Alliances Office in the Technology and Commercialization office and by related offices at NASA HQ and other NASA Centers. Past successes include the Mattel Hot-Wheel series of spacecraft toys, Uncle Miltie toys, consulting on television and movie scripts, exhibit alliances with Disneyland and Epcot, among others. Mars participates in an annual "Toy Day" for industry, in which potential licensees learn about opportunities related to Mars missions, spacecraft, and data. Toys and video games that use real data are particularly attractive given their ubiquitous presence in households. The near-term goal is to explore commercial partnership opportunities, and have a major toy line in place in the near- to mid-term. In the long-term, subject to allowability and NASA policy, the goal will be to generate a revenue stream that can flow back into the Mars Public Engagement Program. Such funds would potentially generate an ability to invest in more science, engineering, mathematics, and other space-related education for the public overall, and for teachers and students in particular.

Commercialization can provide unique opportunities to Share the Adventure and Make Mars a Real Place, limited only by the creativity and interest of potential partners. Commercialization efforts can help meet Goal 1 (Communicate the Story) and Goal 5 (Infusion of New Ideas) through Objective 1 (Visualizations and Virtual Experiences) and Objective 4 (Easy, Assured Access).

This activity supports NASA Strategic Goal 6 (6.1.1-4, 6.3.4, 6.4.2) and Goal 7 (7.1.1-2) and NASA Office of Education Operating Principles, especially F (Partnerships/Sustainability). See Appendices I and J.

ROADMAP Activity A: COMMERCIALIZATION		
Near-term (FY02-FY04)	Mid-term (FY05-FY10)	Long-term (FY11-FY20)
Explore opportunities for innovative commercialization opportunities.	Seek a significant Mars product line and begin exploring potential revenue streams back into the program.	

4.0 Conclusion

Public Engagement is a vital part of NASA's Mars Exploration Program, which is fully committed to educating and informing the public about discovery related to the red planet. The public is the ultimate customer and stakeholder in missions to Mars and all that they provide in new knowledge and technologies. Both make space exploration possible and also provide substantial benefits here on Earth. Today, there are unprecedented opportunities to give back to the public even more: solid educational programming that will inspire and teach the next generation of space explorers; inspirational and visual experiences at museums and in homes; and engaging, interactive means of connecting with mission teams and events, to name a few.

The aim is ambitious: to create a nationwide, community-based presence in people's lives through our vision: to Share the Excitement and to Make Mars a Real Place. And yet, Mars exploration presents the possibility of a continuous stream of missions with focused science and technology goals to tie them all together. Just as each mission strategically complements and builds on another, Mars Public Engagement will seek to create a focused and cohesive program from its collection of planned activities. The "threads" in crosscutting activities, formal education, informal education, and public outreach bind individual activities in each time period, with early activities geared toward existing and new programs that will provide experience in key activity areas. Building on the lessons learned and the relationships fostered by engaging in these early activities, Mars Public Engagement will seek to deepen and widen its outreach in each "thread" area over time. Depending on effectiveness, not all near-term activities will necessarily be pursued throughout the course of the next decade, but all provide connective experiences and a strong base from which a widely recognizable, highly participative program can emerge.

To the greatest extent possible, activities in each area will be connected to others that are on-going. Evaluating the potential for "matches" (e.g., how a specific museum project links to an educational effort for higher leverage) among public engagement projects will be a high priority. Linking various partner organizations together can also provide stronger programs and innovative ideas. By building a long-term program, a web of strong relationships, a thematic focus, and multiple means of participation and interaction, Mars Public Engagement can truly make Mars exploration belong to and serve the citizens who ultimately make it possible.

Appendix A: Mars Exploration Program Science Goals

The following summary was excerpted from Science Planning for Mars Exploration, "Part 2: Scientific Goals, Objectives, Investigations, and Measurements" (JPL Publication 01-7). This document is the product of a science working group called the Mars Exploration Payload Analysis Group (MEPAG), which is responsible for linking Mars science goals to specific investigations that can be made either by science payloads aboard spacecraft or through Earth-based laboratories. The Chair for MEPAG during the course of this study was Dr. Ron Greeley, Arizona State University.

GOAL 1: DETERMINE IF LIFE EVER AROSE ON MARS

Objective A: Determine if Life Exists Today

Investigation 1: Map the 3-D distribution of water in all its forms.

Investigation 2: Carry out in-situ exploration of areas suspected of harboring liquid water.

Investigation 3: Explore high-priority candidate sites (i.e., those that provide access to near-surface liquid water) for evidence of extant (active or dormant) life forms.

Investigation 4: Determine the array of potential energy sources available on Mars to sustain biological processes.

Investigation 5: Determine the nature and inventory of organic carbon in representative soils and ices of the martian crust.

Investigation 6: Determine the distribution of oxidants and their correlation with organics.

Objective B: Determine if Life Existed on Mars in the Past

Investigation 1: Determine the locations of sedimentary deposits formed by ancient and recent surface and subsurface hydrological processes.

Investigation 2: Search for martian fossils (morphological and chemical biosignatures of ancient life).

Investigation 3: Determine the timing and duration of hydrologic activity.

Objective C: Assess the Extent of Prebiotic Organic Chemical Evolution

Investigation 1: Search for complex organic molecules in rocks and soils.

Investigation 2: Determine the changes in crustal and atmospheric inventories of carbon through time.

GOAL 2: CHARACTERIZE THE CLIMATE OF MARS

Objective A: Characterize Mars' Present Climate and Climate Processes

Investigation 1: Determine the processes controlling the present distributions of water, carbon dioxide, and dust.

Investigation 2: Determine the present-day stable isotopic and noble gas composition of the present-day bulk atmosphere.

Investigation 3: Determine the long-term trends in the present climate.

Investigation 4: Determine the rates of escape of key species from the martian atmosphere and their correlation with solar variability and lower atmosphere phenomenon (e.g., dust storms).

Investigation 5: Search for micro-climates.

Investigation 6: Determine the production and reaction rates of key photochemical species (O_3, H_2O_2, CO, OH, etc.) and their interaction with surface materials.

Objective B: Characterize Mars' Ancient Climate and Climate Processes

Investigation 1: Find physical and chemical records of past climates.

Investigation 2: Characterize the history of stratigraphic records of climate change at the polar layered deposits and residual ice caps.

GOAL 3: CHARACTERIZE THE GEOLOGY OF MARS

Objective A: Determine the Nature and Sequence of the Various Geologic Processes (Volcanism, Impact, Sedimentation, Alteration etc.) that have created and modified the martian crust and surface.

Investigation 1: Determine the present state, distribution, and cycling of water on Mars.

Investigation 2: Evaluate sedimentary processes and their evolution through time, up to and including the present.

Investigation 3: Calibrate the cratering record and absolute ages for Mars.

Investigation 4: Evaluate igneous processes and their evolution through time, including the present.

Investigation 5: Characterize surface-atmosphere interactions on Mars, including polar, eolian, chemical, weathering, and mass-wasting processes.

Investigation 6: Determine the large-scale vertical structure and chemical and mineralogical composition of the crust and its regional variations, including the structure and origin of hemispheric dichotomy.

Investigation 7: Document the tectonic history of the martian crust, including present activity.

Investigation 8: Evaluate the distribution and intensity of impact and volcanic hydrothermal processes through time, up to and including the present.

Objective B: Characterize the structure, composition, dynamics, and history of Mars' interior

Investigation 1: Characterize the configuration of Mars' interior.

Investigation 2: Determine the history of the magnetic field.

Investigation 3: Determine the chemical and thermal evolution of the planet.

GOAL 4: PREPARE FOR HUMAN EXPLORATION OF MARS

Objective A: Acquire martian environmental data sets,

Investigation 1: Determine the radiation environment at the martian surface and the shielding properties of the martian atmosphere.

Investigation 2: Characterize the chemical and biological properties of the soil and dust.

Investigation 3: Understand the distribution of accessible water in soils, regolith, and martian groundwater systems.

Investigation 4: Measure atmospheric parameters and variations that affect atmospheric flight.

Investigation 5: Determine the electrical effects in the atmosphere.

Investigation 6: Measure the engineering properties of the martian surface.

Investigation 7: Determine the radiation shielding properties of the martian regolith.

Objective B: Conduct in-situ engineering science demonstrations

Investigation 1: Demonstrate terminal phase hazard avoidance and precision landing.

Investigation 2: Demonstrate mid-L/D, aeroentry/aerocapture vehicle flight.

Investigation 3: Demonstrate high-Mach parachute deployment and performance.

Investigation 4: Demonstrate in-situ propellant (methane, oxygen) production and in-situ consumables production (fuel cell reagents, oxygen, water, buffer gases).

Investigation 5: Access and extract water from the atmosphere, soils, regolith, and martian groundwater systems.

Investigation 6: Demonstrate deep drilling.

Objective C: Emplace infrastructure for future missions

Investigation 1: High-capacity power systems in support of robotic sample return missions and eventual human support.

Investigation 2: Communications infrastructures to support robotic missions with high data rates or a need for more continuous communications, and eventual human support.

Investigation 3: Navigation infrastructure to support precision landings for robotic or human missions.

Appendix B: Mars Exploration Program Milestones

The Mars Exploration Program will send orbiters, landers, rovers, and scouts on missions to the red planet every 26 months for the next fifteen years. The exploration strategy is to "follow the water," given that water is key to understanding the past and current environment on Mars and the potential for past, present, or future life on the planet. All missions advance the four science goals of the Mars Program: 1) Determine if Life Ever Arose on Mars; 2) Characterize the Climate of Mars; 3) Characterize the Geology of Mars; and, 4) Prepare for Human Exploration.

Key Mars Program Milestones that will guide our public engagement activities include the following mission schedules. Missions are each "assigned" to a given time period on the basis of their arrival dates, since that is when public engagement activities associated with the missions and their science results are at a high. That said, there is certainly overlap among the near-, mid-, and long-term periods, and public engagement activities will include mission information prior to launch, at launch, during cruise, and onward over the lifetime of the individual mission. The key Mars Program Milestones listed below are subject to change, and will be updated as necessary through the change log associated with this plan.

NEAR-TERM (FY02 – FY04)

Mars Global Surveyor

March 1999 – April 2002	Mars Global Surveyor Mapping Operations
Jan 2004 – June 2004	Data Relay Mission

2001 Mars Odyssey

April 2001	Launch
October 2001	Orbit Insertion
January 2002 – June 2004	Science Mission
June 2004 – September 2005	Data Relay Mission

Mars Exploration Rovers

May 2003	Launch MER-A
June 2003	Launch MER-B
January 2004 - ?	Landing and Operations

Mars Express

June 2003	Launch
December 2003	Mars Orbit Insertion
December 2003 – March 2004	Beagle 2 mission operations
March 2004 – November 2005	Orbiter Science Operations
November 2005 – November 2008	Data Relay

MID-TERM (FY05 – FY10)

Mars Reconnaissance Orbiter

August 2005	Launch
March 2006	Orbit Insertion
March 2006 – July 2008	Prime Science Mission
July 2008 – February 2016	Data Relay/Navigation

Phoenix

August 2007	Launch
May 2008	Mars arrival
May 2008-July 2008	Prime Science Mission

Mars Telecommunications Orbiter

October/November 2009	Launch
August 2010	Mars Orbit Insertion
August 2010 - August 2020	Prime Science Mission

Mars Science Laboratory

2009 or 2011	Launch
TBD	Mars Landing
TBD	Prime Science Mission

LONG-TERM (FY11 – FY20)

Mars missions for the 2010-2020 decade are currently being considered by the Mars Exploration Program. Options may include sample returns, drilling, and other discovery-driven investigations.

These key dates will guide many of the budget allocations (see Appendix G), particularly for "surge" activities that occur just prior to, during, and just after major mission events, when public and media attention is particularly high. Allocations to visualizations (for multiple formal, informal, and public outreach purposes) and internet investments will go up accordingly in these times. Core programs that are not event-dependent will be maintained and enhanced throughout the span of the currently planned Mars program in order to meet the objectives as outlined in the roadmaps.

Appendix C: Guiding Documents

Section 1-4: The role of education and public outreach, NASA Space Science Enterprise Strategic Plan, November 2000

Space missions have revealed the universe through new eyes and opened up new worlds to explore and understand. They have shown us that black holes really exist, and have given us fundamental new information about the origin and evolution of planets, stars, galaxies, and the universe itself. They have opened up the tantalizing prospect of searching for life beyond Earth. By engaging the imaginations of teachers, students, and the general public, space science has demonstrated the extraordinary potential for strengthening interest in science and improving the quality of science, mathematics, and technology education in America. By attracting bring individuals to advanced study in technical fields, space science also plays a significant role in ensuring a continued cadre of trained scientists, engineers, and technologists to meet our society's needs in the 21st century.

Education and Public Outreach Objectives	Education and Public Outreach Activities
Share the excitement of space science discoveries with the public Enhance the quality of science, mathematics, and technology education, particularly at the pre-college level Help create our 21st century scientific and technical workforce	Incorporate a substantial, funded education and outreach program into every space science flight mission and research program Increase the fraction of the space science community that contributes to a broad public understanding of science and is directly involved in education at the pre-college level Establish strong and lasting partnerships between the space science and education communities Develop a national network to identify high-leverage education and outreach opportunities and to support long-term partnerships Provide ready access to the products of space science education and outreach programs Promote the participation of under-represented and underutilized groups in the space science program by providing new opportunities for minorities and minority institutions to compete for and participate in space science missions, research, and education programs Develop tools for evaluating the quality and impact of space science education and outreach programs

To meet our goals and objectives, we integrate education and public outreach into all space science mission and research programs. The resulting program is an important element of NASA's overall education effort, and was designed in close collaboration with the NASA Office of Human Resources and Education and the Office of Equal Opportunity Programs. NASA mandates that the Agency "involve the education community in our endeavors to inspire, America's students, create learning opportunities, enlighten inquisitive minds," and "communicate widely the content

relevance, and excitement of NASA's missions and discoveries to increase understanding and broad application of science and technology."

It is our fundamental premise that all Americans should be able to participate in the adventure of exploring and understanding the universe. The Enterprise works closely with both the space science and education communities to identify education and outreach opportunities focused on the needs of educators and the general public. Establishing productive, long-term partnerships between educators and space scientists helps maintain this focus. Our education and outreach information and materials are made readily available in a variety of formats useful to educators and suitable for bringing the accomplishments of the Space Science Enterprise to the general public.

Other guiding documents include:

- NASA Education Enterprise Strategy (2005)
- Mars Exploration Program Plan (2001); updated 2005
- Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs (1995)
- Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy (1996)

Appendix D: Roadmaps

ROADMAP FOR CROSSCUTTING ACTIVITIES			
Activity	**Near-term (FY02-FY04)**	**Mid-term (FY05-FY10)**	**Long-term (FY11-FY 20)**
Thread 1: Management			
Activity A: Comprehensive Plans, Reviews, Reports, and Evaluation	Continue to improve upon use of the WBS, WA, and other management systems; work with mission teams and scientists collaboratively; and, establish evaluation process.	Show solid impact as a result of programming and improvements to Mars Public Engagement per evaluations.	
Activity B: Risk Communications	In cooperation with the JPL Risk Communications Coordinator and other responsible parties, develop and disseminate risk communications materials and contribute to joint risk communications planning.	Contribute to, and participate in, any activities outlined in the developing Mars Risk Communications Plan (potentially including public meetings and briefings).	
Thread 2: Community Input			
Activity A: Innovation & Feedback Workshops	Design and begin implementing innovation and feedback workshops that allow external experts, customers, and partners (including scientists) to infuse the program with new ideas and best practices.	Continually assess ways of enhancing the workshops per participant evaluation and demonstrate that advice was successfully incorporated into programming.	
Activity B: Proposal Solicitations	Conduct research that leads to the design of a well-thought-out program for proposal solicitations.	Begin implementation and show impact of proposal solicitation program in extending Mars Public Engagement.	
Activity C: Principal Investigator Participation	Form good working relationships with Principal Investigators and science teams to extend reach of national program and establish means to incorporate their ideas into planning and implementation.	Work with Principal Investigators and science teams in creating Public Engagement Payloads.	
Thread 3: Visualizations			
Activity A: Visualizations & Visualization Infrastructure	Continue to fund the creation of multi-purpose, experiential imagery and invest in infrastructures that allow their timely, quick, easy, and uninterrupted delivery.	Provide increasing levels of "virtual Mars" experiences during Scout, Smart Lander, and other missions.	
Thread 4: Speaker Support			
Activity A: Travel and Materials Support	Provide updated visuals and "speaker kits" and actively seek feedback from science and engineering speakers to deliver needed and requested support.	Have in place an identifiable and expanding base of Mars speakers in communities around the country, and an easy means for organizations to identify possible speakers and long-term relationships with them.	

Appendix D: Roadmaps (cont'd)

ROADMAP FOR FORMAL EDUCATION ACTIVITIES			
Activity	**Near-term (FY02-FY04)**	**Mid-term (FY05-FY10)**	**Long-term (FY11-FY 20)**
Thread 1: Student Imaging & Analysis			
Activity A: Mars Student Imaging Project	Gain experience and build teacher base through Mars Student Imaging Program.	Make large Mars data sets (from Viking onward) widely accessible to classrooms in easy-to-use form.	
Activity B: Student Imaging Interns	Gain experience in initial student intern program and form "virtual" student analysis teams (connected through e-learning) for wider reach.	Sponsor intern opportunities with future mission teams and make large Mars data sets available for expanded experiences for increasing numbers of users.	
Thread 2: Mars Robotics Education Partnership			
Activity A: Mars Robotics Education Partnership	Gain experience through Mars Robotics Education Partnership by developing progressive learning opportunities and the internet capability for the public to "joystick" around Mars with virtual rovers.	Make large Mars data sets from the Mars Science Lab and other missions available in real-time for expanded robotics education experiences for increasing numbers of users.	
Activity B: FIRST Robotics	Build on engineer involvement with under-served students through FIRST Robotics and build Mars content into mentoring discussions.	Work with national FIRST organization to create and insert Mars content into an aspect of the nationwide program.	
Activity C: "Survivor" Rover Competition	Research and planning (inc. research on ground-based sites, operation of rovers through communications satellites and GPS, contacts with potential Air Force or commercial airline partners, and small grant opportunity for concept studies).	With an experienced cadre of students and teachers who have participated in near-term robotics education programming (Mars Robotics Education Partnership, FIRST), sponsor a "Survivor style" rover competition here on Earth.	
Thread 3: Science Through Arts, Letters, and Humanities			
Activity A: Imagine Mars	Leverage the previous NASA investment and new funds from interagency partners to recreate an arts & sciences program called Imagine Mars (formerly Mars Millennium).	Build on the experience gained through "Imagine Mars" to introduce science and math through working with a network of art museums and other interested orgs.	
Activity B: Partnership with State Education Departments	Create a partnership with California or other State Education Department and assess opportunities with other states.	Pilot program with California or other State Education Departments, with a goal of integrating Mars-related content into state frameworks for education or into statewide teacher training programs.	
Activity C: Mars Exploration Literacy Initiative	Research and plan opportunities for beginning a literacy program.	Create a Mars Exploration Literacy Initiative.	
Thread 4: Educator Workshops			
Activity A: Nation-wide Workshops	Continue to build on current workshops and begin working with minority and other colleges and universities to develop workshops for pre-service teachers.	Demonstrate that workshops serve as a "feeder" into other ongoing Mars educational programs to create personalized, long-term relationships with interested teachers and establish a strong program with minority and other universities based on their input.	
Activity B: Mars Education Extension Centers at Informal Education Orgs	Begin making connections with museums that hold educational workshops, assess interest, and gather input.	Partner with informal education organizations to create "extension centers" for holding educator workshops frequently nationwide.	

Appendix D: Roadmaps (cont'd)

ROADMAP FOR INFORMAL EDUCATION ACTIVITIES			
Activity	**Near-term (FY02-FY04)**	**Mid-term (FY05-FY10)**	**Long-term (FY11-FY 20)**
Thread 1: Networks and Alliances			
Activity A: Visualization Alliance	Create Visualization Alliance for real-time shows during MER landing and operations.	Build on initial Visualization Alliance partners for future missions as more informal education institutions add new technology capability and programming.	
Activity B: Solar System Ambassadors	Continue to expand participants in Solar System Ambassadors.	Have a specialized cadre of Mars Ambassadors in all 50 states.	
Activity C: Space Place	Continue to expand participants in Space Place and assess participant interests for future directions.	Leverage early relationships with partners to form new alliances based on the input from participants.	
Activity D: Long-term Partnerships with Museums Receiving NASA Grants	Initiate Partnerships with Museums Receiving NASA Grants and assess opportunities for collaboration.	Have a manageable program in place for maintaining and serving ongoing relationships, based on a needs and desires assessment of the institutions involved.	
Activity E: National Parks Initiatives	Identify national parks that are "Mars on Earth" sites and form an alliance to discuss and assess the possibilities (e.g., Earth/Mars displays, interpretive ranger professional development etc.).	Successfully implement National Parks Initiative, with Earth/Mars displays in major Mars analogue sites here on Earth and professional development opportunities for key national park staff.	
Thread 2: Models and Materials			
Activity A: Spacecraft Model Loan Program	Initiate more accessible model loan program and allow museums to buy in on MER rover models by advertising the opportunity through association and other networks.	Have Mars models in locations nationwide and well-recognized program for model loans.	
Activity B: Product Dissemination to Informal Education Associations	Assess needs and desires, create a plan, and research and implement dissemination means beyond those currently known to informal education organizations and other groups (e.g., youth, community, special-interest)	Have in place easy-to-access systems for new, data-rich materials that the informal education community desires.	
Thread 3: Informal Educator Professional Development Opportunities			
Activity A: Informal Educator Workshops	Initiate, pilot and assess workshops for informal educators and begin to hold them regularly in regions around the country.	Have in place a solid, recognizable, and successful program that reaches all states and is highly responsive to feedback from participants.	

Appendix D: Roadmaps (cont'd)

ROADMAP FOR PUBLIC INFORMATION & OUTREACH ACTIVITIES			
Activity	**Near-term (FY02-FY04)**	**Mid-term (FY05-FY10)**	**Long-term (FY11-FY 20)**
Thread 1: Internet Initiatives			
Activity A: Internet Equipment and Infrastructural Investments	Assess needs and make investments, particularly in relationship to the 2003 rover mission, and begin to implement accessibility requirements.	Continue to research and invest in future technologies and capabilities enhance the public's access to data and to a "virtual" experience with Mars and its exploration and maintain a capability to deal with peak demand during key mission events.	
Activity B: Web Contests and Interactive Features	Hold web contests to attract interest and assess participation and begin developing interactive web features.	Provide a wide-range of exciting interactive features that create virtual experiences.	
Activity C: Mars Email Project	Work with scientists and engineers to provide content supporting Mars Email Project.	Work with scientists and engineers toward use and popularity of interactive Mars email project and develop the potential for emails to be sent to spacecraft in the future.	
Activity D: Mars @ Home	Invest in visualizations for a "Digital Mars" experience that people can enjoy at home.	Demonstrate measurable and dramatic demand in downloads for "Digital Mars" data and interactive programs.	
Activity E: Red Planet Club	Assess process, structure, and resource needs for a Red Planet Club.	Nationwide members of Red Planet Club, with assessment of participant satisfaction.	
Thread 2: Media Support Initiatives			
Activity A: Documentary Footage	Begin documentary films and regular dissemination and assess public interest.	Have in place a user-friendly, online system for easily accessing beginning-to-end documentary coverage of missions, with measurable increases in downloads from media and the general public.	
Activity B: Expanded Press Kits and Information	Work with mission teams to create information for expanded press kits.	Have in place a system for disseminating expanded press kits, especially to local media outlets where Mars work is being conducted around the country.	
Activity C: New Relationships	Begin to form long-term relationships with nontraditional and minority press.	Have a routine, yet proactive, program in place for outreach to nontraditional press, with the goal of seeing a measurable increase in Mars stories covered.	
Thread 3: Community-Building Initiatives			
Activity A: Environmental Initiative	Make contact with potential partners (e.g., environmental organizations focused on water resources) and evaluate possible relationships.	Have in place widely recognizable partnerships that encourage education on water quality and efficiency (or other suitable areas) in alignment with federal, state, and local goals.	
Activity B: Mars Time Capsule Project	Pave the way for a Mars Time Capsule Project by identifying necessary resources and relationships.	Have time capsules in all 50 states.	
Thread 4: Commercialization			
Activity A: Commercialization	Explore opportunities for innovative commercialization opportunities.	Seek a significant Mars product line and begin exploring potential revenue streams back into the program.	

Appendix E: Activities' Alignment with Plan's Goals and Objectives

	T1 MANAGEMENT	Plans, Reviews, Reports	Risk Communication	T2 COMMUNITY INPUT	Innovation & Feedback Workshops	Proposal Solicitations	PI Participation	T3 VISUALIZATIONS	Visualizations & Infrastructure	T4 SPEAKER SUPPORT	Travel and Materials Support	T1 STUDENT IMAGING & ANALYSIS	Mars Student Imaging Project	Student Imaging Interns	T2 ROBOTICS EDUCATION	Mars Robotics Partnership	FIRST Robotics	Survivor Rover Competition	T3 ARTS, LETTERS, HUMANITIES	Imagine Mars	Mars Literacy Initiative	T4 EDUCATOR WORKSHOPS	Nationwide Workshops	Extension Centers	State Partnerships	T1 NETWORKS & ALLIANCES	Visualization Alliance	Solar System Ambassadors	Space Place	Museums with NASA Grants	National Parks Initiative	T2 MODELS & MATERIALS	Spacecraft Models	Product Dissemination	T3 PROFESSIONAL DEVELOPMENT	Workshops	T1 INTERNET INITIATIVES	Equipment Infrastruc. Investments	Web Contests & Interactives	Mars Emails	Mars @ Home	Red Planet Club	T2 MEDIA SUPPORT	Documentary Footage	Expanded Press Kits	New Relationships	T3 COMMUNITY BUILDING	Environmental Initiative	Mars Time Capsules	T4 COMMERCIALIZATION
	CROSSCUTTING											FORMAL EDUCATION														INFORMAL EDUCATION											PUBLIC INFO & OUTREACH												
GOAL																																																	
1. Communicate Story of Mars Exploration	X	X			X	X	X		X		X		X			X	X	X		X	X		X	X			X	X	X		X	X			X		X	X	X		X	X	X	X	X	X
2. Diversity and Educational Equity	X	X	X		X	X	X		X		X		X			X	X			X	X		X	X	X		X	X	X	X	X			X	X		X			X	X		X	X		
3. Communicate Mission Safety	X	X			X	X	X		X		X						X	X					X	X																			X	X				
4. Direct Public Involvement	X	X			X	X	X		X		X		X			X	X	X																		X	X	X	X	X				X	X			
5. Infusion of New Ideas	X		X		X	X	X		X		X		X					X																X			X		X	X				X	X		
OBJECTIVE																																																
1. Visual Experiences	X				X	X	X		X		X		X			X				X						X	X	X	X	X	X		X	X		X		X	X			X		X		X
2. Strong Networks	X	X	X		X	X	X		X		X		X							X			X	X	X		X	X	X	X	X	X		X	X					X			X	X		
3. Science Through Arts	X				X	X	X		X		X					X				X	X				X					X											X						
4. Easy, Assured Access	X	X	X		X	X	X		X		X		X							X			X	X			X	X	X	X	X			X	X		X	X	X	X	X	X	X	X	X	X	X
5. Public Engagement Payloads	X				X		X		X				X					X									X				X																
6. Real-time Data and Expert Interactions	X	X			X	X	X		X		X		X			X	X						X	X			X	X		X			X			X		X	X	X	X	X		X			

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Chapter 6 in the National Science Education Standards details eight categories of science content standards that indicate what students should know, understand, and be able to do in the natural sciences over the course of K-12 education. This appendix covers all eight categories.

Presented in the left-hand column are the top-level standards, which have detailed "Guides" too lengthy to list in this document. However, matches between standards and science goals in this Appendix were determined based on how the Mars science goals matched the "Guides to the Standards." Thus, the match may or may not be evident without referring to the Guides in Chapter 6 of the National Science Education Standards. Some may be stronger matches than others.

A comprehensive document has been prepared by Mars Public Engagement staff. It explains in greater detail how the standards (and the guides) correlate with Mars science goals, and is available for reference upon request.

Category 1: UNIFYING CONCEPTS AND PROCESSES CONTENT STANDARDS

UNIFYING CONCEPTS & PROCESSES	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-12				
Systems, order, and organization	X	X	X	X
Evidence, models, and explanation	X	X	X	X
Change, constancy, and measurement	X	X	X	X
Evolution and equilibrium	X	X	X	X
Form and function	X	X	X	X

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 2: SCIENCE INQUIRY CONTENT STANDARDS

SCIENCE INQUIRY CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Abilities necessary to do scientific inquiry	X	X	X	X
Understandings about scientific inquiry	X	X	X	X
5-8				
Abilities necessary to do scientific inquiry	X	X	X	X
Understandings about scientific inquiry	X	X	X	X
9-12				
Abilities necessary to do scientific inquiry	X	X	X	X
Understandings about scientific inquiry	X	X	X	X

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 3: PHYSICAL SCIENCE CONTENT STANDARDS

PHYSICAL SCIENCE CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Properties of objects and materials	X	X	X	X
Position and motion of objects		X	X	
Light, heat, electricity, and magnetism	X	X	X	X
5-8				
Properties and changes of properties in matter	X	X	X	
Motions and forces		X	X	
Transfer of energy	X	X	X	X
9-12				
Structure of atoms	X	X	X	
Structure and properties of matter	X	X	X	
Chemical reactions	X	X	X	X
Motions and forces	X	X	X	X
Conservation of energy and increase in disorder		X		
Interactions of energy and matter		X	X	

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 4: LIFE SCIENCE CONTENT STANDARDS

LIFE SCIENCE CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Characteristics of organisms	X	X	X	X
Life cycles of organisms	X			
Organisms and environments	X			X
5-8				
Structure and function in living systems	X			X
Reproduction and heredity	X			
Regulation and behavior	X			X
Populations and ecosystems	X	X	X	X
Diversity and adaptations of organisms	X	X	X	
9-12				
The cell	X			
Molecular basis of heredity	X			X
Biological evolution	X			
Interdependence of organisms	X	X	X	X
Matter, energy, and the organization of living systems	X			
Behavior of organisms	X	X	X	X

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 5: EARTH SCIENCE CONTENT STANDARDS

EARTH SCIENCE CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Properties of Earth materials	X	X	X	X
Objects in the sky		X	X	
Changes in earth and sky		X	X	
5-8				
Structure of the Earth system	X	X	X	
Earth's history	X	X	X	
Earth in the solar system		X	X	
9-12				
Energy in the Earth system		X	X	
Geochemical cycles		X	X	
Origin and evolution of the Earth system	X	X	X	
Origin and evolution of the universe				

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 6: SCIENCE & TECHNOLOGY CONTENT STANDARDS

SCIENCE & TECHNOLOGY CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
Distinguish between natural and human-made objects	X		X	X
5-8				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
9-12				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 7: SCIENCE IN PERSONAL & SOCIAL PERSPECTIVES CONTENT STANDARDS

SCIENCE IN PERSONAL & SOCIAL PERSPECTIVES CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Personal health				X
Characteristics and changes in populations				
Types of resources		X	X	X
Changes in environments	X			X
Science and technology in local challenges				X
5-8				
Personal health				X
Populations, resources, and environments				X
Natural hazards		X	X	X
Risks and benefits	X	X	X	X
Science and technology in society	X	X	X	X
9-12				
Personal and community health				X
Population growth				X
Natural resources			X	X
Environmental quality		X		X
Natural and human-induced hazards				
Science and technology in local, national, and global challenges	X	X	X	X

Appendix F:
Correlation between Mars Science Goals and National Science Education Standards

Category 8: HISTORY & NATURE OF SCIENCE CONTENT STANDARDS

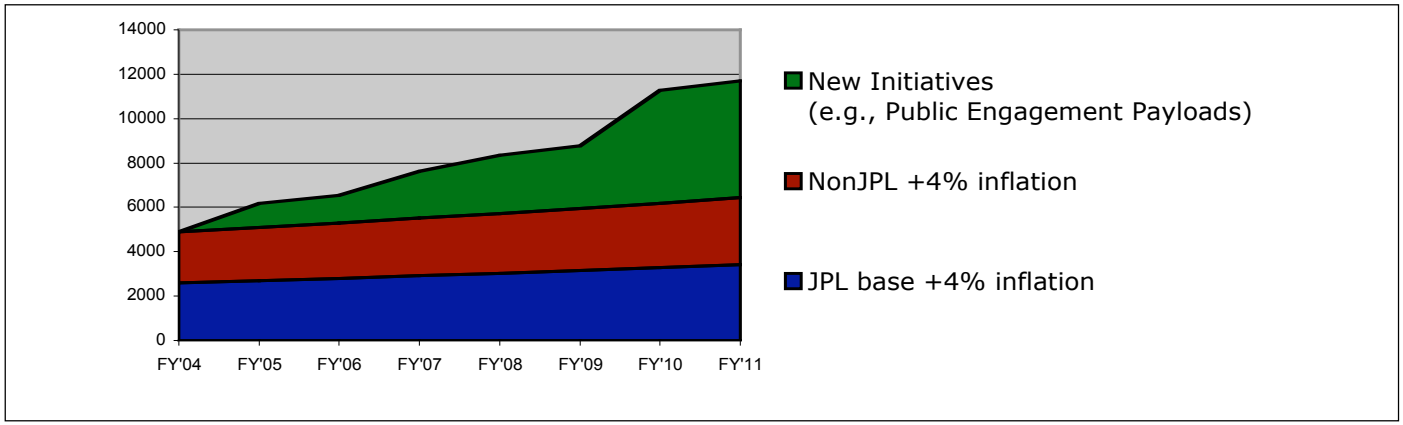
HISTORY & NATURE OF SCIENCE CONTENT STANDARDS	Mars Science Goal 1: Determine if Life Ever Arose on Mars	Mars Science Goal 2: Characterize the Climate of Mars	Mars Science Goal 3: Characterize the Geology of Mars	Mars Science Goal 4: Prepare for Human Exploration of Mars
K-4				
Science as a human endeavor	X	X	X	X
5-8				
Science as a human endeavor	X	X	X	X
Nature of science	X	X	X	X
History of science	X	X	X	X
9-12				
Science as a human endeavor	X	X	X	X
Nature of scientific knowledge	X	X	X	X
Historical perspectives	X	X	X	X

Appendix G:
Mars Public Engagement Budget

Mars Public Engagement is funded at the 1% level of the Mars Exploration Program budget. To align better with NASA Office of Education goals, targets are as follows: 45% Formal Education, 35% Informal Education, and 20% Public Outreach.

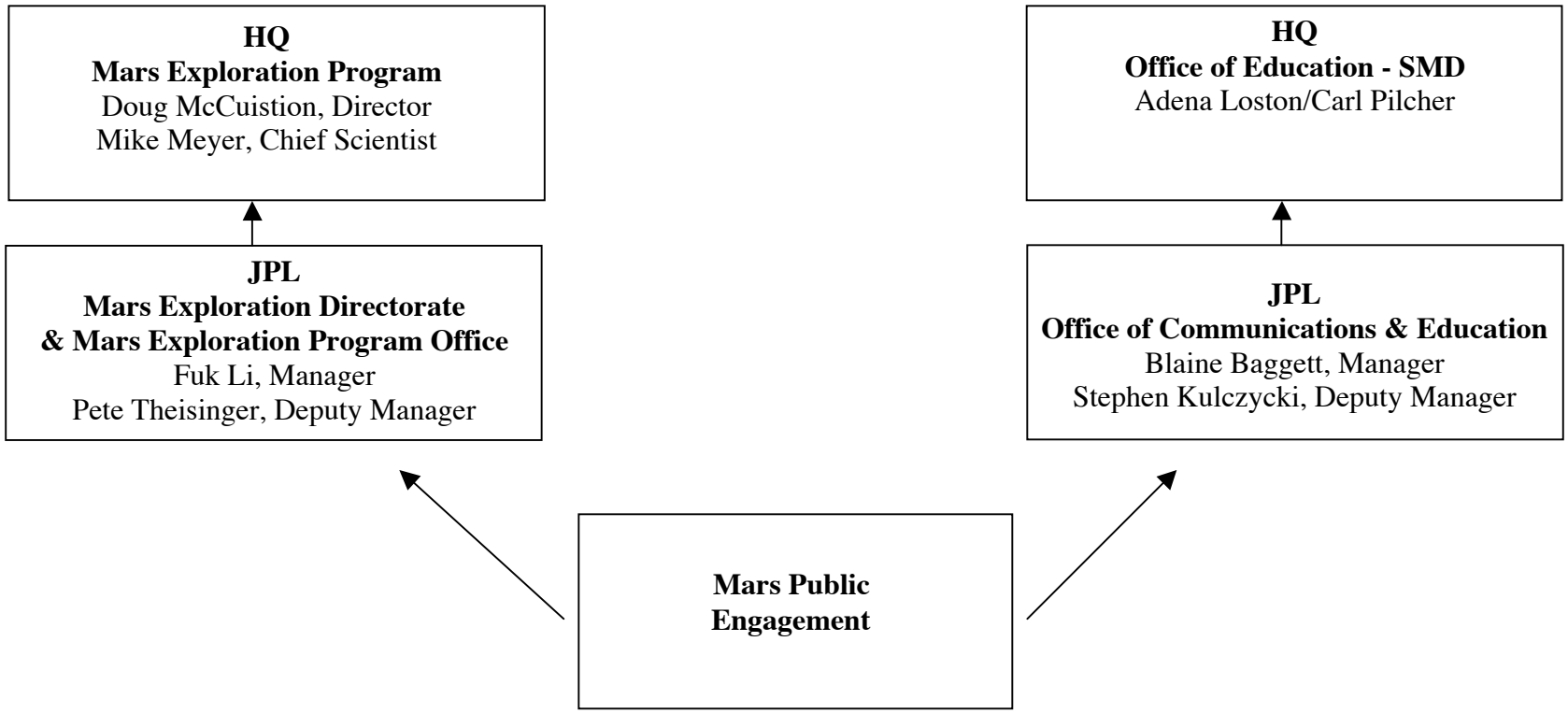
Prospective Project Operating Plan, in millions										
Near-term			Mid-term						Long-term	
FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12-20
2.9	3.9	4.9	6.1	6.5	7.6	8.3	8.7	11.2	11.7	TBD

Mars Public Engagement has a baseline infrastructure requirement for JPL staff supporting Mars Public Engagement Plan activities and key events for all Mars Exploration Program missions (see org charts in Appendix H). Based on the near-term budget profile (baseline FY04), the JPL and NonJPL base for ongoing programs are shown with a nominal 4% inflation rate. As the program grows in budget, more resources become available for further competitively awarded initiatives supporting the Mars Public Engagement Plan, including larger budget items such as support for Public Engagement Payloads.



Appendix H:

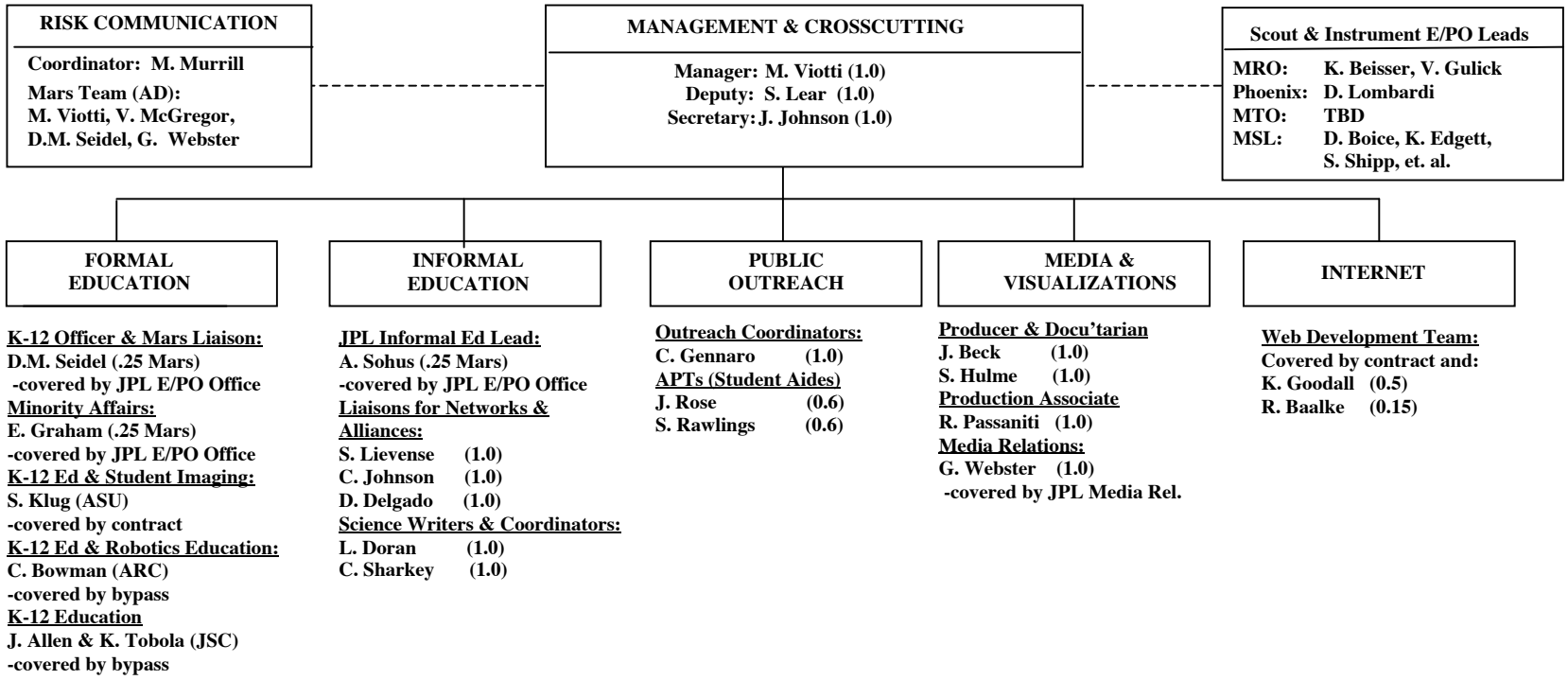
Mars Public Engagement Organization Chart



Program management for Mars Public Engagement is the responsibility of the Mars Exploration Program Manager at JPL. The JPL Office of Communications and Education serves as the line management organization for most of the JPL staff on the Mars public engagement team (exception: technical staff for internet).

The Mars Public Engagement team works closely and collaboratively with all organizations, and takes advantage of the knowledge and skills of the wider science, engineering, and communications communities.

Appendix H:
Organizational Chart



(#.#) = FTE Time; alternate funding indicated with others

N.B. While the above staff members are listed under topical "boxes," they all work closely and collaboratively as a team. As with the budget, staff supporting visualizations and the internet contribute to formal education, informal education, and public outreach alike. Staff are also liaisons to the mission science and engineering teams and are responsible for planning all aspects of public engagement surrounding mission milestones (launches, arrivals, landings and operations). They also coordinate public events (including speaker support and model loans for formal and informal education and public outreach events) and responses to public inquiries. Scout and Instrument E/PO leads and cognizant E/PO Mars leads at other NASA Centers are also connected to the team through telecons and community meetings in order to ensure joint planning, leveraging, coordinating, and reporting. The JPL Communications and Education office lends additional support to the team through the expertise and time of cognizant individuals from other E/PO areas of knowledge and responsibility.

Appendix I

Six operating principles in the 2003 NASA Education Enterprise Strategy currently serve as NASA performance/evaluation criteria:

A. Customer Focus: Programs have been designed to respond to a need identified by the education community, a customer, or customer group	
A.1	The program is based on a compelling mutual need.
A.2	NASA can make an effective content contribution.
A.3	Participants find the program valuable.
A.4	The program is accessible to its intended audience.
B. Content: Programs make direct use of NASA content, people, or facilities to involve educators, students, and/or the public in NASA science, technology, engineering, and mathematics	
B.1	The program is based on NASA's scientific and technical activities, reflecting "As only NASA can."
B.2	Program content is technically accurate.
B.3	The program engages the public in shaping and/or sharing the experience of exploration and discovery.
B.4	The program is aligned with recognized and endorsed education reform efforts. • Explicitly acknowledge alignment with education standards in one or more of the following educational fields: science (earth and space science or biological and physical science), mathematics, technology, or geography. • Provide evidence that education partners engaged in developing and evaluating curricular products or educator training are knowledgeable about how to align activities (or products) with relevant education standards. • Provide evidence of the existence of substantive links or partnerships that target urban areas, states, and/or regions where National Science Foundation systemic reform efforts have been implemented that would increase the scope and impact of the proposed/planned/ongoing effort.
C. Pipeline: Programs make a demonstrable contribution to attracting diverse populations to careers in science, technology, engineering, and math.	
C.1	The program promotes careers in STEM. • teacher and student use of NASA data • research experiences for students and teachers • exposure to career options through hands-on participation in STEM enrichment programs
C.2	The program promotes improvement of STEM skills • engaging students in formal and informal educational settings in participatory activities, such as hands-on learning, research, the use of innovative technology, peer support groups, and mentoring relationships with professionals and college students • involving teachers in effective and extensive staff development opportunities to improve their content knowledge in STEM areas • increasing pre- and in-service teacher participation in STEM enrichment programs • training middle- and high-school academic counselors in STEM career paths and the academic requirements for pursuing such career paths • increasing parent awareness of, and involvement in, student programs in STEM subjects to strengthen family support of STEM education • directly involving families in activities in academic or non-academic settings designed to promote awareness of STEM subjects or STEM careers
C.3	The program creates linkages to other STEM educational opportunities. • directly coupling program participants to other NASA research, internship, scholarship, or fellowship programs • utilization of partnerships or substantive linkages with the Math and Science Partnership Program (Department of Education/National Science Foundation) and/or Centers for Learning and Teaching (National Science Foundation) • coupling to STEM-skill-enhancement activities by community groups, corporations, research labs, museums, and educational/professional orgs

Diversity: programs reach identified targeted groups	
D.1	The program serves individuals from underrepresented groups and ensures accessibility to people with disabilities.
D.2	The program promotes opportunities for faculty at minority serving institutions (Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), and Other Minority Universities (OMUs)) to engage in research consistent with NASA's goals, objectives, and requirements.
D.3	The program supports closing identified gaps in STEM proficiencies among diverse populations.
D.4	The program provides awareness and understanding through culturally appropriate materials to targeted communities of how NASA's research and innovations affect and improve the quality of life for all citizens.
D.5	The program has been or will be developed in close consultation with members of the communities it is intended to serve and delivered through community partners (as appropriate) for the purpose of serving diverse populations of educators and students.
Evaluation: programs implement an evaluation plan to document outcomes and demonstrate progress toward achieving objectives	
E.1	The program is evaluated regularly by credible sources following professionally accepted standards for educational evaluations.
E.2	Evaluations are based on models and techniques appropriate to the object of evaluation. • based upon reputable models and techniques appropriate to the content and scale of the program • designed and implemented by a reputable project partner who is knowledgeable in research and evaluation methods applicable to education efforts • where appropriate, the evaluation plans/processes should include field-testing and modifications based on such testing before broad utilization • evaluation methods provide useful information on the effectiveness and/or impact of the proposed program
E.3	The program implements improvements based on evaluation evidence.
E.4	The program collects, analyzes, and reports output and outcome data to a common NASA database to determine program reach, scope, and effectiveness and meet the requirements of program stakeholders.
Partnerships/Sustainability: programs achieve high leverage and/or sustainability through intrinsic design or the involvement of appropriate local, regional, or national partners in the design, development, and dissemination	
F.1	The program identifies partners and clearly defines the terms of the partnership. • well-defined roles and specific tasks are substantively related to the analysis, design, development, dissemination, implementation, or evaluation of education activities for each of the partners, and these roles and tasks are suitable/sufficient to ensure successful program implementation • partners have the expertise, experience, and capabilities required to plan and implement their responsibilities in the collaboration • evidence is provided that partners are actually committed to carrying out the program; letters of partnership intent, specific support, or other evidence of the reality of the partnership are included or attached to the proposal or program plan or are explicitly discussed in the program summary
F.2	The program provides cited or estimated figures for the fiscal contribution of each partner
F.3	The program (or key aspects of it) is replicable in other educational institutions or settings
F.4	The program is sustainable beyond initial NASA funding (potential for continuation beyond the period of direct NASA funding, adoption by the target audiences, and/or incorporation into institutional programmatic efforts).
F.5	The program can expand its scope (achieve higher leverage) by: • having an impact beyond the direct beneficiaries • reaching relatively large audiences • being suitable for broad dissemination • drawing on resources beyond those directly requested in the proposal or plan or the funds actually being provided in the case of an ongoing program

Appendix J: Activities' Alignment with NASA Goals & Objectives

Goal 6: Inspire and motivate students to pursue careers in STEM		
Obj. 6.1	**Elementary and Secondary Participation:** Increase the number of elementary and secondary students and teachers who are involved in NASA-related education opportunities	
6.1.1	Student Participation	By 2008, increase by 20% student participation in NASA instructional and enrichment activities.
6.1.2	Educator Support	By 2008, increase by 20% the number of elementary and secondary educators effectively utilizing NASA-content-based STEM materials and programs in the classroom.
6.1.3	Family Support	By 2008, increase by 20% family involvement in NASA-sponsored elementary and secondary education programs.
6.1.4	Institutional and System Support	By 2008, 90 percent of NASA elementary and secondary programs are aligned with state or local STEM educational objectives.
Obj. 6.2	**Higher Education Capability:** Support higher education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related careers.	
6.2.1	Student Pipeline	By 2008, attain a statistically significant increase in number and diversity of NASA-supported students graduating in NASA-related fields.
6.2.2	Faculty Competitiveness	By 2008, attain a statistically significant increase in the number of faculty in higher education institutions who are first-time proposers in NASA research and development opportunities.
6.2.3	Preservice Education	By 2008, increase by 20 percent the number of higher education institutions that align their NASA-funded research with STEM teacher preparation departments to improve STEM teacher quality.
6.2.4	Student Research	By 2008, increase by 10% the number and diversity of students conducting NASA-relevant research.
Obj. 6.3	**Underrepresented and Underserved Participation:** Increase the number and diversity of students, teachers, faculty, and researchers from underrepresented and underserved communities in NASA-related STEM careers.	
6.3.1	Student Pipeline	By 2008, increase by 20% underrepresented/underserved NASA-sponsored students who pursue academic degrees in NASA-related STEM disciplines.
6.3.2	Teacher/Faculty Support	By 2008, increase by 20% the number and diversity of teachers and faculty from underrepresented/underserved communities and institutions who participate in NASA-related STEM programs
6.3.3	Researcher & Institutional Support	By 2008, increase by 20% the number of underrepresented/underserved researchers and minority-serving institutions that compete for NASA research and development opportunities.
6.3.4	Family Support	By 2008, increase family involvement in underrepresented/underserved NASA-sponsored student programs.
Obj. 6.4	**e-Education:** Increase student and public access to NASA education resources via the establishment of e-Education as a principal learning support system.	
6.4.1	Education Technology R&D	By 2008, identify and implement four new advanced technology applications that will positively impact learning.
6.4.2	Learning Tools and Materials	By 2008, demonstrate the effectiveness of NASA digital content materials in targeted learning environments.
6.4.3	Digital Learning/ Content Services	By 2008, establish a technology infrastructure that meets citizen demand for NASA learning services.

Appendix J Continued: Activities' Alignment with NASA Goals & Objectives

Goal 7: Engage the public in shaping and sharing the experience of exploration and discovery.		
Obj. 7.1	**Informal Education:** Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions	
7.1.1	National Program	By 2008, establish a national program to engage the informal education community with NASA science and technology.
7.1.2	Instructional Materials	By 2008, provide instructional materials derived from NASA research and scientific activities that meet the needs of NASA's informal education partners.
7.1.3	Professional Development	By 2008, provide professional development for NASA's informal education partners.

The following chart correlates the Plan's major areas of focus ("threads") with NASA goals and objectives.

	ALIGNMENT WITH NASA GOALS & OBJECTIVES																						
	Goal 6																			Goal 7			
Focus Areas ("Threads") in the Mars Public Engagement Plan	**6.1**	6.1.1	6.1.2	6.1.3	6.1.4	**6.2**	6.2.1	6.2.2	6.2.3	6.2.4	**6.3**	6.3.1	6.3.2	6.3.3	6.3.4	**6.4**	6.4.1	6.4.2	6.4.3	**7.1**	7.1.1	7.1.2	7.1.3
CROSSCUTTING																							
Management	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Community Input	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Visualizations	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Speaker Support	X		X	X		X	X		X		X	X	X		X					X	X	X	X
FORMAL EDUCATION																							
Student Imaging and Analysis	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X				
Robotics Education	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X				
Science Through the Arts, Letters, & Humanities	X	X	X	X	X						X	X	X		X	X		X					
Educator Workshops	X	X	X		X	X	X		X		X		X			X	X	X	X				
INFORMAL																							
Networks & Alliances	X	X	X	X	X	X	X		X		X			X	X	X		X		X	X	X	X
Models & Materials	X		X																	X	X	X	X
Professional Development											X		X	X		X		X		X	X	X	X
PUBLIC OUTREACH																							
Internet	X	X	X	X	X	X	X		X	X						X	X	X	X	X		X	
Media Support																				X		X	
Community-building Programs	X	X	X	X		X	X				X	X			X					X	X	X	
Commercialization						X	X									X		X		X		X	

Appendix K: Summary of Reviews/Evaluation

PROGRAMMATIC REVIEWS/EVALUATIONS

The evaluation strategy in the FY02-04 start-up phase was to assess usability and adoptability of pilot programs, making changes based on customer input. This kind of formative design evaluation is critical and precedes impact studies (questions of causality such as did X raise student achievement?), as a well-designed program increases the long-term likelihood of both positive impacts and widespread, systemic use. All data and results from the first three years are also preserved and archived for use in planned impact evaluations in the next phase (FY05-10). A Harvard School of Education class is preparing recommendations for evaluation plans, and a competed proposal process for external evaluators will begin in FY05. Mars Public Engagement was also reviewed by HQ:

- **2004 NASA Office of Education Review**
  - **only program to receive an "Excellent" rating; incorporating feedback from that review**
- **2003 NASA Office of Education Review**
  - **overall score of 89%**
  - **tied for 3rd among all NASA education programs reviewed**

INDIVIDUAL ACTIVITY ASSESSMENTS

- **ongoing educator workshops typically receive 4+ of 5 in post-workshop educator evaluation surveys; educator workshops were also included in umbrella Lesley University evaluation sponsored by the former Office of Space Science**
- **programs involving students have used "empowerment evaluation" techniques to modify programs based on student input related to ease of use, comprehensibility etc.**

PRODUCT REVIEWS/EVALUATIONS

- **2004 OSS Product Review Process:**
  - **beginning robotics activities received "Excellent" rating ("Marsbound")**
- **2003 OSS Product Review Process:**
  - **Mars Student Imaging curricular activities received "Excellent" rating**
- **2002 Office of Space Product Review Process:**
  - **Earth/Mars classroom activities received "Excellent" rating**